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ABSTRACT

This publication reports on a project designed to increase the awareness and appreciation of educators, and through them the awareness of middle and high school students, of the advantages of preparing for careers in technology and science. These are fields in which Boston high school students generally, and minority students particularly, have been underrepresented. In this project--Technology and Science Careers for Minorities (TSCM)--the Massachusetts Institute of Technology Work in Technology and Science (MIT/WITS) group served as the catalyst for Boston public schools and local technological companies. Through workshops, site visits, career materials, and classroom programs, Boston educators from 16 schools developed knowledge about careers and their prerequisites. They also realized that these careers represent excellent possibilities for minorities and that teachers, counselors, and administrators are in critical roles for expanding students' perceptions of career options. The publication summarizes the following aspects of the project: career awareness; educator's questions; establishing linkages; educators' workshops; student field trips; classroom speakers; materials and other services; educators' recommendations; and a summary of participants' reactions. Appendixes contain lists and tables of associates with WITS in the TSCM project; forms and letters; and materials used to link technological organizations to schools. (KC)

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Work in Technology and Science: Linking Education and Employment

Edith Ruina

Technology and Science Careers for Minorities
A program of staff development for Boston middle and high school teachers, counselors, and administrators

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The Technology and Science Careers for Minorities program was funded by federal Emergency School Aid Act provisions for university-business cooperation. It was planned and directed by WITS under a sub-contract from the Boston School Department from September 1, 1979 to July 31, 1980.

Contributions to this report were made by TSCM personnel Edith Ruina, Nadine Rodwin, Vivian Johnson, Richard Deveney, and Jennifer Porter. Alice S. Amdur was Editorial Consultant.

WITS-MIT Project on Work in Technology and Science, Room 20C-228, Cambridge, Massachusetts 02139. (617-253-7378)

Cover photograph taken at a student field trip at Input-Output Computer Services, Inc., Waltham, Massachusetts; Spring, 1980.

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THE SCHOOL COMMITTEE OF THE CITY OF BOSTON

BOSTON PUBLIC SCHOOLS
OFFICE OF THE SUPERINTENDENT
ROBERT WOOD

July 8, 1980

Mrs. Edith Ruina
Massachusetts Institute of Technology
Project on Work in Technology
and Science
Room 20C-228
Cambridge, MA 02139

Dear Mrs. Ruina:

The Technology and Science Careers for Minorities (TSCM) project addresses a significant set of issues that are very important to the Boston schools. Throughout the time of my association with the Boston Public Schools I have been concerned about the low participation of minorities from our schools in those careers that are such a significant piece of the Massachusetts economy. We know that the science, mathematics and technical courses that would qualify people for good career prospects in these areas do not have sufficient participation of minorities.

It is most heartening for me to know that through WITS, the Boston schools have made major strides in linking our educational programs with the technological industries. The Boston educators who participated now know that there are possibilities for our students in those companies. The many people who represented their companies also know that the Boston schools want to and can capitalize upon their willingness to help expand our students' knowledge and motivation. This will enlarge the pool of talented minority people who can become members of their work force.

We are in the midst of discussions with the federal ESAA office regarding continuation of the TSCM and other projects. I recognize how much more could be accomplished with funding for continuation and I plan to exert my efforts to that end.

It is clear that WITS' good work generated the enthusiasm and commitment of many people to share in this endeavor. It is evident, as well, that MIT and its larger collegial community enhance the capacity of the Boston schools to prepare youngsters for our technological society. We should plan to build on this year's program to provide awareness of careers and of applications of technology to math, science, and interdisciplinary curricula.

May I take this opportunity to thank the WITS staff for its contributions.

With every good wish,

Robert Wood
Superintendent

Introducing the Project

This publication reports on an unusual project designed to increase the awareness and appreciation of educators, and through them the awareness of middle and high-school students of the advantages of preparing for careers in technology and science. These are fields in which Boston high-school students generally, and minority students particularly, have been very underrepresented. In this project—Technology and Science Careers for Minorities (TSCM)—the Massachusetts Institute of Technology Work in Technology and Science (MIT/WITS) group served as the catalyst for Boston schools and local technological companies. Through workshops, site visits, career material, and classroom programs, Boston educators from 16 schools developed knowledge about careers and their prerequisites. More important, perhaps, they realized that these careers represent excellent possibilities for minorities and that teachers, counselors, and administrators are in critical roles for expanding students' perception of career options. The program was conducted in cooperation with the Boston Public Schools.

The TSCM project depended upon the good will and commitment of people in many organizations. Some are named, either in the text or in the appendices; others were "behind the scenes"—the staff of the Emergency School Aid Act office, other administrators in the Boston system; and a host of other men and women who shared with us their wisdom and gave us much practical assistance.

We are indebted to the Massachusetts Institute of Technology for furnishing us with a base, both physically in terms of space and resources, and psychologically by providing a supportive environment of faculty members and others with experience and insights into the nature and requirements of a technological world.

My overall responsibility for the direction of the TSCM project was complemented by Nadine Rodwin. In a most thoughtful and competent way, she managed the day-to-day operation of the many and complex project activities. The dedicated secretarial support of Toni Paganis assured the attention to detail essential to this kind of program.

The following pages will try to explain why the project was undertaken, what competency WITS had to assume the task, what the program consisted of, who participated, and how well the program worked, both from the point of view of the organizers and the participants.

Edith Ruina
Cambridge, Massachusetts
July 1980

Focus on Career Awareness

It seems clear that many jobs being created today require technical background: national employment patterns show that the market for engineers, technicians, and computer specialists, for example, is quickly growing, but too few minorities are represented in these fields, despite equal education and employment legislation and regulations.

Throughout their schooling, students acquire little understanding about the technological world. Most educators themselves have had little opportunity to learn about a broad range of careers. Even math and science teachers are unfamiliar with the engineering, science and related technical applications of their subjects and are handicapped, therefore, in explaining to students why they are necessary in many careers; nor are they prepared to use technology as a way to provide hands-on experience that makes science or math more engaging for all students.

Boston teachers and guidance counselors need greater understanding of the labor market to understand how to help their students achieve effective transitions from education to work. A study prepared by the Department of Management Information Services on Boston public schools—An Assessment of Needs to Support the 1978-79 Emergency School Aid-Act—noted that in addition to reinforcing basic skills in mathematics, more curriculum for career and occupational education was needed.

The Boston schools have already tried to incorporate a greater understanding of the world of work into the system by pairing schools with businesses. However, most of the court-ordered pairings are with businesses that do not include many technology and science options—although every company now has computer-related jobs. Up to now, Boston teachers and counselors have had little opportunity to develop relations with the Greater Boston area technology and science companies. This lack of career knowledge undoubtedly limits students' awareness of choices and of the relevance of their school subjects.

A follow-up study of graduates from the Boston public high schools in 1978 illustrates this problem. Eight hundred and fifty-five graduates who had entered full-time employment following graduation responded. These included 489 males and 366 females. Of the eight classes of occupations listed, only 29 males (3.3%) and 7 females (.8%) were employed in the technical category. Thus, there is a clear indication that recent male graduates of Boston high schools are poorly represented in technical employment with women's participation negligible or nonexistent.

Desegregation of the Boston schools has served to emphasize the fact that minority students have had even less encouragement than white students to study math and science. Not being encouraged, and avoiding math or science in school, has cut them off from more advanced education in technology and science, left them inadequately trained for desirable jobs, and with little understanding of labor market needs. Opportunities for teachers to design and implement school-based programs that foster equal student enrollment need to be created particularly in the areas of math and science to reduce real differences in performance.

Science has traditionally had low priority in American education in the pre-college years, and it has been considered almost "off-limits" for the non-academically gifted. Few Boston students enroll in elective science courses. The Boston high schools generally require only one year of math for non-college-bound students, and two years of science. Moreover, many teachers report that with a tradition of "social promotions" to keep students at an appropriate age/grade level, many students complete each school year without having developed sufficient knowledge.

It is within this context that WITS, building upon its past experience, undertook to assist Boston schools expand their capacity to develop the untapped resources of minority and other students. The program of Technical and Science Careers for Minorities is a continuation of WITS' earlier efforts to enhance the schools' capacity to prepare students for life in a technological society.

Our project has been evolving since 1973, originating with an MIT Workshop on Women in Science and Technology. This was one of the first conferences in the country devoted to the complex issues of expanding female participation in technical areas where they are underrepresented—a serious societal problem of underutilization of human resources. Workshop recommendations and discussions of educators and employers over several months eventually resulted in WITS receiving a three-year grant from the Massachusetts Department of Education under Title IVC of the Elementary and Secondary Education Act (ESEA). Local technological companies, educational institutions, and government agencies provided speakers, site visits, and materials to people from over 40 schools. Companies seemed eager to avail themselves of opportunities for interacting with educators through an organized program. Perhaps the most exciting and intensive part of the WITS program was the provision of summer internships for over 50 teachers and counselors, immersing them in the technological world. This was made possible by additional funding from the Massachusetts Division of Occupational Education.

The importance of encouraging female participation has continued to be a priority, and is, of course, an aspect of the TSCM program since approximately half of the minority students happen to be female. When we speak of "women and minorities" it unfortunately obscures the necessity to give special attention to female minority members. Even though more black women than men go to college, a much lower percentage go into the technical fields.

This year, with the TSCM focus on minorities, both men and women, we remain convinced that catalysis will continue to be necessary if reasonable priority is to be given to linking education and work for minorities or other target groups. For despite rhetoric about the importance of such linkages, or of eliminating race and sex segregation in occupations, or of developing career awareness and technological literacy, these are rarely articulated as program priorities in schools or in industries.

If work-education programs are to be effective, they require considerable planning and many personal contacts, and neither in schools or in industries is there much staff time or accountability for such endeavors. Perhaps this is understandable, given the primary missions of these institutions.

Programs linking education and work have generally targeted a small percentage of students with special academic problems. Rarely do they provide career awareness for a broad range of students, nor are they likely to encourage many minority young people to pursue math and science or to enroll in post-secondary technical programs.

WITS programs are primarily for teachers, counselors, and administrators who deal with many students with all ranges of ability, and who can carry the message to students in succeeding years. The goal is not place students in jobs, or to assign them too soon to narrowly specialized fields, but rather to encourage the academic preparation that will keep their options open.

Research on career development indicates that parents and peers are the primary influences upon career choice. Too often, the key role of parents is taken to mean that therefore the schools cannot be influential. The WITS premise is that it becomes even more incumbent upon schools to play a role if we truly want minorities and women to become part of the scientific and technical work force. Because of their own inexperience, parents may be unable to assist their children in these directions. So, if we want the excluded groups to hear other than traditional messages about their futures, teachers and counselors are in unique positions to help students and their parents to perceive the full range of choices.

Some of the recurring questions that were asked by Boston educators in the past year as they sought to help their students prepare for careers are dealt with in the next section.

What Educators Asked

In preliminary discussions with the educators, and increasingly during the course of the program, certain concerns kept surfacing. Some of the recurrent questions are treated here.

Are there really jobs? We have heard so much about engineering unemployment.

Although there are variations among the various branches of engineering, the national employment outlook for the profession as a whole is good for the eighties. The same applies to engineering and science technicians, of whom there were a little over half a million. In Massachusetts, the growth rate in the demand for high technology electrical engineers, as well as engineers in general, is projected to be 4% and 3% respectively per year, while total employment in Massachusetts, is expected to grow at 2% per year from 1976 to 1985. "Although more students are now enrolling in engineering than in the 70's, a legitimate concern is that the increased supply will not come close to matching the demand being generated by high technology firms," states a recent study."[1] This implies that the job prospects for those with the right qualificaitons are good in the next few years.

Many other job opportunities also exist in the computer industry. In Massachusetts, this industry is rapidly expanding, and during field trips and talks at schools, it was pointed out time and time again that career opportunities were good even for persons starting at entry level jobs, including clerical and assembly line jobs, anywhere in the computer manufacturing companies. In the fields where computer use is expanding, such as data processing, changes in technology will have varying effects on computer operating occupations over the next decade. Employment of key-punch operators, for example, will continue to decline, while "employment of computer technicians is expected to grow much faster than the average for all occupations through the mid-1980's"[2]

In Massachusetts, employment in the so-called high technology manufacturing industries which include electronic computing equipment, electrical machinery and supplies, and several other smalled categories, is expected to increase from 1976 to 1985 by over 38% (i.e., an increase of 67,000 jobs).[3]

The speakers emphasized repeatedly that the basic math and science skills are important in many other careers which are not entirely technical. Among the things which participants learned from the program was that not only is there a demand for technically and scientifically trained people, but also that these basic skills are needed everywhere.

[1] Employment Requirement by Occupation by Industry 1976-1985, Massachusetts Division of Employment Security, p. 20.
[2] Reprint from the U.S. Department of Labor, Occupational Outlook Handbook, Office Machine and Computer Occupations, Bureau of Labor Statistics, Bulletin 1955-6, 1978, pp. 6-8.
[3] Employment Requirement by Occupation by Industry, 1976-1985, Op. cit., p. 6.

What can we tell students who don't have good grades or who don't want to continue after high school?

In the course of workshops, classroom programs, and visits to companies, educators began to perceive possibilities for those young people and reasons for encouraging them to keep up with as much math and science as possible.

Educators learned about the "internal labor market" in companies. Many entry jobs exist in all technological companies for people without special training—for example, production and office jobs. Once people are in these jobs, they have a chance to acquire experience; companies post jobs for their own employees and like to promote from within. Companies also have tuition reimbursement plans.

Several people who are now in technical jobs, who had not been strong students in academic subjects, described discovering their technical abilities and interests after high school. On a site visit, one young person, a high-school dropout, described how he became first a helper and than an apprentice to a mechanical technician. He discovered on the job that he could learn algebra; he completed high school and plans to go to college soon.

Educators heard about other students who did not have high grades in high school who succeeded at Wentworth Institute of Technology and Northeastern University or in apprenticeship programs. They heard about technician training that requires one or two years of post-secondary education and of the big demand for technicians.

Other routes into these fields are through military service programs, some of which were described at one workshop. Some companies explained efforts that they were making to show women office workers how they could switch into technical work. Materials given to participants explained technician jobs and preparation in more detail.

One counselor now alert to the variety of possibilities summed it up at the final workshop. . . . "Now when C students tell me they are thinking about engineering or a technical job, I tell them about the preparation but urge them to try . . . after all, I am not God—I do not have a crystal ball . . . People can make it if they want to."

What about role models?

Those who contributed to workshops for educators and classroom programs demonstrated the range and variety of careers in technological and scientific areas. That was important. But even more significant, they demonstrated that there are opportunities for people with different kinds of interest and abilities, and that there are different ways to enter these fields. The minority engineers and technicians proved that minorities have made it, often after overcoming social and economic handicaps.

The success stories told by the technicians and engineers sometimes had the paradoxical effect of making the educators feel that these people "made it" because of social, economic, or familial advantages that many Boston students do not have. Despite some of this feeling, several teachers and counselors became more hopeful about possibilities for their students by year's end.

In line with research findings, there proved to be no simple recipe for whom students considered good role models. A speaker, whether black or white, who was too technical turned students off. An older black scientist made students feel they, too, could make it. A white female engineer and a black technician had kids on the edge of their seats. What seemed to matter most was the ability to capture attention and to hold it.

The people who spoke shattered some stereotypes that influence counselors. Most work roles in technology do not separate people who are "people" oriented from those who are "things" oriented. Technical people work in teams, and to move up the career ladders communications skills as well as technical competence are essential.

Traditionally, counselors ask students to state their interests or abilities when they are in middle or high school as a basis for future planning. This may eliminate minority or other students who have had no exposure to the world of technology and hence indicate no such preference.

Can a minority person be comfortable working in a technological company?

All company participants in the TSCM program represented companies who want to hire minorities. This does not mean that the people who have been hired by these companies necessarily feel as though they have not encountered problems. A few of them who are enthusiastic about the future for minorities nonetheless pointed out vestiges of discrimination that still may limit promotion or may make personal relationships at work not totally comfortable. But, for the most part, they felt that as more minorities come into organizations the patterns of discrimination will lessen. Legislative affirmative action requirements have accelerated changes in institutional behavior, and changes in individual attitudes and behavior are following.

Why should we refer students to what we think of as boring jobs?

When educators visited companies, the most visible jobs were those in assembly lines, and many of the educators considered these boring. However, one person who had had assembly-line experience in his youth observed how much better the work environments were in the high-technology companies.

In order to confront this attitudinal problem, we planned one workshop that featured people from community agencies who work with minority youth. They said that the definition of a dull and boring job is a matter of opinion, but that the bigger question is whether such an entry-level job is indeed a dead end or whether is has clearly defined career ladder opportunities. Similarly, companies need to demonstrate that they encourage upward mobility for minorities.

How can students get jobs when companies are not located close to public transportation?

Although the middle and high school students are several years away from actual employment, the educators fear that transportation problems for Boston residents will make it impossible for even technically trained people to go to the companies on Routes 128 and 495. Not all companies are inaccessible to public transportation, but in any case we believe that it would be poor planning to limit young people's horizons arbitrarily because of this factor. Experiments have been made from time to time in providing special busses or feeder lines on Route 128 and our hope is that individuals, organizations, and the public transportation system will be willing to confront the transportation problem if it will improve the employment situation both for the companies and for the urban workers. In fact, many companies have experimented with providing company vans or car pools and other schemes to make transportation easier.

Establishing Linkages

Project Personnel

The TSCM staff was basically the staff of the previous WITS project. It was headed by the Director of WITS, Edith Ruina, who took overall responsibility, and the Associate Director, Nadine Rodwin. Together they shared the responsibilities of Educational Coordinator. Support services were performed by an administrative assistant, Jennifer Porter, and a secretary, Toni Paganis, who assumed major responsibility for executing the detailed paper work. The WITS staff was responsible to Barbara Nelson, Associate Director, Division for Study and Research in Education, Massachusetts Institute of Technology. In frequent meetings with the WITS project director regarding implementation issues, she brought to bear her broad knowledge of education as well as her specific knowledge of the Boston system based on her responsibility for MIT's pairing with the "magnet" Umana Technical Harbor School.

The responsibility for liaison and activities in the Boston schools was vested in a Staff Trainer/ Supervisor, Richard Deveney, who had previously been Emergency School Aid Math Coordinator for the Boston School Department. He reported to the Boston Public Schools ESAA Project and to the Educational Coordinator of the WITS/TSCM Project.

WITS called upon an advisory group on an ad hoc basis for recruiting resources and for general advice on issues associated with assuring industry commitment and selection of minority members and others for participation in the program. We also engaged expert consultants. At the beginning of the year, Edward Strickland, Acting Chairperson of the Black Studies Department, University of Massachusetts, provided counsel on issues associated with classroom motivation of students. Vivian Johnson, Educational Consultant, played a major role in planning and executing the final workshop design and reporting on participants' recommendations.

We found that a comparatively small paid staff could generate a large amount of time and effort by other organizations and individuals: Our primary recommendation for staff selection is to utilize people with enthusiasm, commitment, good humor, and good organizational ability.

Schools and School Teams

In September 1979, when the WITS/TSCM program was established, the Boston School Department circulated a letter to all middle and high schools inviting them to participate. A committee was formed to select the 16 target schools from the more than 40 which applied. The final group included nine middle schools and seven high schools, two of which were parochial schools. Criteria for selection included a full team of one math teacher, one science teacher, one guidance counselor, and one administration person. The team was to have at least one female and one minority member. Other considerations affecting selection of the target schools were to favor schools that had rarely had special programs, to complement efforts made by another program targeting minority students in the eighth grade, and to achieve an equitable district-wide distribution of target schools. The participating schools and school teams are listed in Appendix A-1.

Teachers, counselors, and administrators were expected to attend workshops organized by WITS, to provide feedback to the project, and to develop through individual and team efforts in-school activities for students based on the workshops. During the course of the year, although some school teams found time to meet, many did not, apparently because of schedule conflicts, because some counselors had no responsibility for students in target classes, or because a low priority was placed on the value of such meetings. Funds were available to purchase technology and science career-related curriculum materials for each school, to be used in the target classes. One field trip per school was provided. Compensation for the teachers and administrators for the TSCM out-of-school workshops was in accordance with the current collective bargaining agreement.

The Staff Trainer/Supervisor had a busy and varied schedule that changed from month to month to accommodate the needs of the program. After participating in the process of school selection, he visited each school to explain the program to the Principal, and to develop a good working relationship, an essential factor in ensuring that the program would run smoothly. He conferred with individual and team members freely and frequently, distributed appropriate material to the teachers, ascertained their reaction to the progress of the program, and carried their recommendations to the WITS staff. The Staff Trainer/Supervisor explained and distributed pre- and post-tests for the Boston School Department evaluation of ESAA projects. He handled individually with teachers all plans for site visits and for having speakers in their target classrooms. His was an essential role, making the program run smoothly.

The WITS Director conferred periodically with members of the Boston ESAA office, Department of Curriculum and Competency, and the Director of Guidance and reported to the City-Wide Advisory Committee (CWAC).

Recruiting the Experts: Community, University, and Technological Cooperation

Great care was exercized in creating a pool of people we could call upon who shared the goals of TSCM and had something to offer its participants. We needed role models who could present the range of careers in technology and science, and the applications of math and science to those careers. We especially wanted to include minority men and both minority and non-minority women in these roles.

The workshops required people who could deal with issues associated with career development. Psychologists, educators, and representatives of community organizations working on development of human resources talked about motivating youngsters. We located effective speakers through WITS staff connections with many university and community groups seeking to develop human resources. For labor market and career information, we called upon government and university contacts as well as personnel people in companies.

To provide a picture of the uses of technology, we invited an engineer to explain communications satellites, a group of computer experts to talk about the computer, some MIT people to give their perspectives on technology, and we arranged visits to company and university laboratories.

WITS original network of contacts with people in the technological industries was expanded through the cooperation of members of an integrated advisory group (see Appendix A-3) representing the Boston schools, parents, companies, and community agencies. These people, in turn, enlisted executives in their organizations who realized the importance of helping the schools increase the likelihood of minority preparation for technological and scientific careers.

It took a great deal of personal communication, many telephone conversations and visits back and forth, and numerous exchanges of letters to fit a company's available resources to our needs. Most companies sponsor some kind of open house and send out speakers, and once they understood the TSCM goals, the tailored their programs and choice of speakers to provide suitable ones for the Boston educators and their students.

Usually, the actual working out of specific activities of company commitment was delegated by the person at the top, with whom we tried to make our initial contact, to a specific person with whom we then maintained communication. The ongoing contact was likely to be someone in personnel, affirmative action, community relations, education, or college relations.

Although many who were enthusiastic initially were not able to follow through, each of the companies that finally participated selected coordinators who developed a fine-tuned sense of what educators and students would enjoy. People who assume responsibility for cooperating with this kind of program have to identify and recruit appropriate people from their companies. These people, in turn, have to receive a clear message that management thinks the project is important and will free personnel to speak at schools or to organize a field trip. The company representatives with whom we worked recognized the long-range benefits of enlarging the pool of qualified minorities who could become engineers, technicians, and computer scientists.

One company executive who was happy to participate said, "It's important for us to make known our work and opportunities, especially to minority and female students. This is due to the requirements that our investigators must have at least 30 college hours of science. Unfortunately, current numbers of minority/female science majors are small." And another participant was frank about his motives for speaking: " i want to encourage and be an example to young people for any non-traditional career. It also gives me speaking experience."

The WITS staff tried to recruit company and professional participants by speaking at professional gatherings and to student and minority groups both at MIT and elsewhere. We talked about the program and distributed forms which interested persons could complete and return. These forms generated a lot of enthusiasm and good will, but in the end, our most successful cooperation came from direct contacts with the companies. Some letters and forms we used in recruiting appear in Appendix C-1 and C-2.

Educators' Workshops

Attendance at workshops by teachers, counselors, and administrators was a vital part of the TSCM program. School participants met with each other and with speakers from industry and government to discuss a multitude of subjects related to young peoples' career choices. Workshops were planned on the basis of WITS' past experience, and were modified during the course of the year as feedback was gathered from TSCM participants through questionnaires, informal communications with the Staff Trainer/Supervisor and workshop discussions. Some of the educators' comments are quoted later in this section.

Workshop 1:
November 1979
Campbell Resource Center
Dorchester

Dr. Alan Clarke, Executive Assistant to the Superintendent of Boston Public Schools, brought a message of support from Boston Superintendent Dr. Robert Wood. Boston School Committee member, John D. O'Bryant, also stated his recognition of the importance of the program. Following these opening remarks, Arthur E. Carter, Manager of Equal Employment Opportunity and Employee and Community Relations Programs, Honeywell, discussed minority underrepresentation in the technological fields and the importance of motivating female and minority students to consider the technological and scientific careers.

Dr. Edward Strickland, Acting Chairperson of the Black Studies Department, University of Massachusetts and TSCM consultant, coordinated the efforts of several facilitators who subsequently led small group discussions relating to each team's selection on one math and one science class as TSCM "target" classrooms. Dr. Strickland also summarized some of the important work on motivation and the potential for developing greater motivation through enhancing student and parent understanding of career options. At the end of the first session, TSCM participants received copies of the recent New York Times' "Review of Careers in the 80's" so that teachers and counselors could find ways to use the appropriate section of this material with their students.

Facilitators for Small Group Discussions

John Conlon,
Director of Teacher Certification,
University of Massachusetts

John Robinson,
Director of Counseling,
University of Massachusetts

Reginald Williams,
Instructor, Black Studies Department,
University of Massachusetts

Earl Williams,
Graduate Student,
University of Massachusetts

Mary Hope,
Dean of Student Affairs,
Massachusetts Institute of Technology

Workshop 2
December 1979
Wentworth Institute of Technology
Boston

Patricia Garrison, Director of Personnel Services at MIT, moderated the opening presentation by a lively panel of minority "role models" who spoke about their personal and educational backgrounds as well as their current positions in local technological industries. A small-group discussion followed in which participants considered the underrepresentation of Boston public school graduates in technology and science-related careers. Teachers and counselors subsequently discussed how they might effectively develop student interest in math and science through cooperative teaching and counseling efforts.

Norma Clarke's talk later in the day about Mitre's program with Madison Park High School complemented the role model panel; she commented that students seeking employment in the high-technology industries will need to develop basic math and science-related skills, because "You just can't beep-bop your way around a circuit board."

In the afternoon, Dr. Edward Kirkpatrick, President, Wentworth Institute, drew a matrix which graphically illustrated scientific, engineering, and technical jobs. He emphasized that Wentworth encourages applications from all interested students including those with low test scores and/or grades.

Panel of Minority Engineers and Technicians Discussing Their Career Development

Benjamin Brathwaite,
Technician,
Wang Laboratories

Robert Davis,
Assostant to the Vice-President,
Bell Laboratories

Willis E. Gray,
Division Manager,
Polaroid

Irvin M. Lyles,
Manager, Manufacturing Documentation,
Prime Computer

Robert Pinckney,
Engineer,
Draper Laboratories

Horace B. Rogers, Jr.,
Technician,
Factory Mutual Engineering

Willard R. Thompson,
Group Manager,
Digital Equipment Corporation

Facilitators for Small Group Discussions

Clara Hicks,
Senior Curriculum Advisor for Elementary and Middle Education,
Boston Public Schools

John Tsang,
Senior Curriculum Advisor,
Boston Public Schools

Earl Williams,
Graduate Student,
University of Massachusetts

Workshop 3
January 1980
Northeastern University
Boston

The first speaker was F. Williams Sarles, Senior Staff, Lincoln Laboratory, MIT. In his talk, "What Does an Engineer Really Do?", Mr. Sarles described his work on experimental communications satellites. A technologocal oversight—no overhead projector —made it possible for him to demonstrate how ingenious engineers can be!

Mary Kay Tetreault, Area Supervisor, Equal Education Opportunity Bureau, Greater Boston Regional Center, followed Mr. Sarles with her talk "How to Use Career Materials and Get the Most Out of Speakers." Later, math teachers, science teachers, and counselors each grouped for discussion of their respective roles in stimulating student interest in math and science.

After lunch, participants reconvened in school teams to review company brochures and choose an industry site to be visited in February. David Blackman, Director of Minority Affairs, College of Engineering, Northeastern University, then discussed the Junior Engineering Technical Society (JETS) program and introduced another panel of role models who discussed educational options at Northeastern University.

Panel of Students and Educators: Education for Engineering Careers

Ruth Karp,
Associate Dean,
Office of Student Affairs,
Northeastern University

Betty Solzberg,
Professor of Mathematics,
Northeastern University

Enrique Melendez,
Student,
Northeastern University

Lana Schike,
Student,
Northeastern University

Workshop 4
February 1980
Site Visits to Analog Devices, Hewlett Packard, Millipore and Polaroid

During the educators' February vacation, four high-technology companies hosted site visits for approximately twelve participants at each site. Accompanied by TSCM personnel, these educators visited:
Analog Devices (a manufacturer of precision data acquisition products used in measurement and control instrumentation),
Hewlett-Packard (a designer and manufacturer of precision electronic equipment for measurement, analysis and computation),
Millipore (a business involved in the analysis and purification of fluids), and
Polaroid (manufacturer of Polaroid cameras).

Each company organized its site visit in its own way. The common element of all the visits was that they were carefully prepared and that the visitors had ample interpersonal contact with employees. In all companies, persons with different occupations and at different job levels talked with the Boston teachers and counselors.
At Polaroid, the tour was preceded by small group discussions with company representatives. Then various speakers joined the group for lunch, and everyone took pictures with the Polaroid SX-70 camera provided by the company.
At Hewlett-Packard the format was somewhat different: the tour was a larger part of the program and preceded the luncheon conversations with the tour guides and other company officials. Analog similarly conducted a tour of its facility and described the manufacturing and purpose of its products. They showed the engineering offices and the "clean" rooms required for precision parts assembly. Then a panel of workers representing a spectrum of technician and engineering jobs talked about their career development. Some of them had entered through military or CETA training programs, since their family economic and social situation could not have supported their professional development. At Millipore, people using audio-visual aids described Millipore products, the development of prototypes, the transition to mass production and the application of Millipore products to health care. Except at Millipore, which is mainly a headquarters facility, manufacturing assembly operations were visited. Teachers and counselors walked through some of

the assembly lines with a guide who explained the work, and many of them asked questions of employees concerning their educational background, job satisfaction and long-term career goals.

Educators responded to the site visits in a variety of ways; while some found the tour of an assembly operations intrinsically interesting, others resented being exposed to assemblers and technicians rather than to engineers. In general, host industries tended to assume that desks occupied by engineers working out calculations would be perceived by educators as less interesting than viewing the actual physical assembly of a computer or camera or a circuit board.

In a post-site visit evaluation, 37 of the 49 educators who attended the site visits indicated that their attitude about work in technological fields was either more positive after the site visits or that they continued to see advantages as previously. One person indicated feeling more negative, and the remainder continued seeing problems in these areas.

Workshop 5
March 1980
MIT Student Center
Cambridge

The fifth workshop began with small group discussions facilitated by members of Boston's Instructional Support Team. Discussion focused upon realistic strategies for reaching target students with career information in math and science, as well as for developing student interest in math and science. Facilitators summarized participants' comments for a report which was subsequently distributed to TSCM teachers, counselors, and administrators. A panel presentation on the Impact of Computers was followed by a question and answer period.

Facilitators for Small Group Discussions

Brenda Jones,
Boston Public School
Instructional Support
Team

Donald Boyd,
Boston Public School
Instructional Support
Term

Janet Owens,
Boston Public School
Instructional Support
Team

Frederick Checovich,
Boston Public School
Instructional Support
Team

Grace Campia,
Boston Public School
Instructional Support
Team

Walter Wood,
Boston Public School
Instructional Support
Team

Panel on Computer Related Careers

Verniece Hensey,
Information Research
Analyst,
Mitre Corporation

Jim Wisdom,
Teacher of Computer
Science,
Cambridge Rindge and
Latin

Irma Wyman,
Director,
Central Staff Operations,
Honeywell Information
Systems

Tom Yocom,
Manager,
Systems & Administrative
Educational Services,
Digital Equipment

Workshop 6
April 1980
MIT Student Center
Cambridge

The session began with a panel presentation on the topic "Technical and Scientific Careers in the Public Sector," moderated by Helen B. Munzer, Director of Job Market Research, Massachusetts Division of Employment Security. Following the presentation, participants broke into small groups for discussion. Panelists provided a wide array of materials describing careers in science and technology in their organizations, and participants were encouraged to take these materials back to their classrooms. The panelists answered many questions, several of the agencies expressed their desire to continue the relationship with a school, and the possibilities of student work-study programs were discussed.

Panel on Scientific/Technical Careers in the Public Sector

Al Fenton,
Education Coordinator,
Army Boston District
Recruiting Command

Susan Brown,
Biologist,
U.S. Army Corps of
Engineers

Calvin Currington,
Civil Engineer,
U.S. Army Corps of
Engineers

Gordon A. Bruggeman,
Supervisory Metallurgist,
Army Materials and
Mechanics Research Center

James L. Gilchrist,
Personnel Specialist,
Army Materials and
Mechanics Research Center

Barbara Kirkwood,
Textile Technologist,
Army Natick Research
Center

Irving Weitzler,
Director,
Aero-Mechanical
Engineering Laboratory,
Army Natick Research
Center

Earl Burton,
Director of Investigation,
Food and Drug
Administration

Patricia Spitzig,
Drug Specialist,
Food and Drug
Administration

Lewis Aleurs,
Personnel Specialist,
Hanscom Air Force Base

Bob Ellerin,
Senior Staffing Specialist,
Hanscom Air Force Base

Diane Gunn,
Associate Engineer,
MassPort

Tim Kinton,
Building Maintenance
Facilities Manager,
MassPort

Joseph Ellis,
Associate Sanitary
Engineer,
Massachusetts Department
of Environmental
Quality Engineering

Workshop 7
May 1980
MIT Student Center
Cambridge

This session focused on the topic, "Work and Youth Employment." Panelists discussed the Vice-President's Commission on Youth Employment, and the proposed $175 million program designed to improve the teaching of basic skills to link schooling with work. The educators also heard about the Urban League of Massachusetts and its local and national programs in career development and youth employment. In addidion, a regional officer from the Massachusetts Department of Education described her work with parents, and efforts to develop collaborative programs which promote equality of education and prepare students for the world of work.

Panel on Issues Involved in Youth Education and Employment

James Patterson,
Executive Director,
Massachusetts Pre-
Engineering Program for
Minority Students
(Mass Pep)

Derek Coelho,
Manager,
In-School Program,
Youth Entitlement
Service (Y.E.S.)

Dolores Swan,
Assistant Director
Regional Office,
Massachusetts Depart-
ment of Education,
Springfield

Adriana Stadecker,
Employment Planner for
Youth Grants,
Center for Employment
and Income Studies,
Heller School,
Brandeis University

Modesto Maldonado,
Guidance Counselor,
Greater Lawrence
Regional Technical School

Deborah Barr,
Occupational Educational
Coordinator,
Tri-Lateral Council for
Quality Education

Donald King,
Coordinator,
Pre-Work Orientation
(Y.E.S.)

Emory Jackson,
President,
Urban League of Eastern
Massachusetts

Workshop 8:
June 1980
MIT Student Center
Cambridge

Session 1

The June workshop was a full two-day session; activities on the first day included the following:

1 Each school team worked together to complete a final program evaluation on a questionnaire.
2 A newly released film sponsored by the Massachusetts High Technology Council entitled "Technologically Speaking" was screened by filmmaker Carl Sykes, Career Communications, Vocational Guidance Programs for Schools and Industry.
3 Four teams met to discuss and recommend strategies for continuing career awareness activities in each TSCM school.

After lunch, all TSCM participants gathered for general discussion by the group facilitators about group recommendations. Participants then departed for site visits at six MIT locations, including the Arteriosclerosis Center, Computer Graphics Laboratory (Architecture), Energy Lab (Combustion), Environmental Medical Services, Nuclear Research Reactor, and the Word Processing Center (School of Engineering).

Session 2

At the final TSCM session, three professors from MIT addressed themselves to the question of how "mainline" curriculum can incorporate technology. Presentations were given to math and science teachers by Ernest Cravalho, Professor of Mechanical Engineering; Ray Pariser, Associate Director for Education, Sea Grant Program; and Louis Bucciarelli, Associate Professor, School of Engineering. These talks were intended to stimulate ideas and discussion about how applications of technology could be included in math, science, or inter-disciplinary curricula. Counselors and administrators, meeting together, heard presentations related to the guidance of students toward careers in science and technology by Phyllis Wesley, Assistant Director of Admissions, University of Massachusetts, Harbor Campus, Boston; Dorothy States, Manager of Equal Employment Opportunity, Honeywell: and Vivian Gilfoy, Project Director, "Second Look," Education Development Center (EDC). Following these presentations, teachers, counselors, and administrators formulated recommendations regarding curriculum and staff development relating to applications of technology. TSCM participants subsequently reconvened to hear facilitator reports on these recommendations at a session moderated by Leon Trilling, Professor of Aeronautics and Astronautics, MIT. These recommendations are summarized in the section "Getting It All Together."

Moderators of TSCM Group Discussions and Panelists Presenting and Commenting on Recommendations

Sally Diaz,
Director,
Central Massachusetts Regional Education Center

Norma Clarke,
Manager,
Personnel Relations,
Mitre Company

Lillie Davis,
Guidance Counselor,
Malden High School

Derek Coelho,
Manger,
In-School Program,
Youth Entitlement Service (Y.E.S.)

Phillip Harrington,
Educational Director,
Action for Bostom Community Development (ABCD)

John Turner,
Associate Dean of Graduate School, MIT

Marianne Abrams,
Executive Director,
Tri-Lateral Council for Quality Education

Comments of Participants
after the first three workshops had been held were helpful in pinpointing what aspects of the program were valued and what suggestions the participants had for future workshops. Among the "most liked" aspects were:

"The interplay with professionals in technical careers—prospect of getting these professionals into the classroom."

"Contacts with business representatives of various companies who are ultimately going to hire our kids—more small-group time with these businessmen would be appreciated."

"Personal experiences of minority role models."

"New information."

"Meeting with people in technical fields and universities, particularly students of engineering, whose remarks are closer to our needs as teachers of younger students."

"My consciousness about careers in technology has definitely been raised—speakers have helped."

Working with teachers from other schools in the city and discovering that we all have similar problems, especially in subject matter."

There was an overwhelming feeling that the workshop at Wentworth Institute was excellent. **"The best, most articulate, intelligent panel I have ever met."**

Mentioned among the "least liked" aspects were:

"Not enough time to talk to fellow counselors about common problems."

"Parts of the program designed to show me how to present career materials and how to motivate my students. I don't need this type of expertise."

And from another:

"We know how to teach—Let us have time to organize our ideas using your materials and resources."

"The sessions for the most part are from a white middle-class standpoint. A minority should have run the workshop."

"Inadequate summarizing and follow-through."

"Highly technical speakers."

Suggestions for the future included:

"Using the resources (expertise) of the group members and/or other career education coordinators in the Boston school system."(Names were given.)

"Skip the lunch period."

"Allow more time for lunch."

"Have free lunch."

"Longer gaps between speakers and for discussion purposes. Most speakers go right out the door."

"Start on time and stick to schedule. Hope that there will be follow-up next year."

"More emphasis on top-rate schools rather than mediocre places."

"Physical set-up is important (heat, comfort, sound, etc.)."

"Now that this program is starting to reach the classroom level, thought needs to be given to follow-up and expansion of the program. I am a former participant in a workshop program designed to bring career education into the Boston schools. This was an excellent program but it floundered when there was no follow-up, no second state. I fear the same thing will happen here."

Student Field Trips and Classroom Speakers

Opportunity for personal interaction with people in technological careers through field trips and classroom programs was a key part of the TSCM program. Students, as well as their teachers and administrators, saw or heard first-hand what goes on in a scientific or technical organization and got a better idea of some careers for which the students may seek to prepare themselves. The variety of males and females, minority and other, whom educators and students met were fine role models and the students' response to them was very favorable. The organizations that hosted student field trips and those that sent speakers to classrooms are listed below. A chart of all the organizations participating in the TSCM program appears in Appendix A-2.

A field trip to a company is not an outing to a science museum. It is intended to be a learning experience where youngsters see the world at work. Yet it can be fun, and the students, in most cases, were enthusiastic. Although pushing buttons, operating machinery or handling materials is not always possible, many organizations, whenever and wherever possible, tried to provide hands-on experience for the students. In some cases, they even gave them some reject parts to take home. And one company distributed "T" shirts. But, most important of all to the students was the direct contact with employees at the company, the opportunity to ask questions about careers, the chance to see and hear about new and exciting techniques, equipment, concepts. Not all field trips, however, were to manufacturing establishments. Technical educational institutions, government research facilities, and public utilities were also part of the program. Field trips at the MIT nuclear reactor and solar house included talks by professionals on energy and the basic chemistry and physics involved. At the New England Telephone Company, large-scale computers were seen. At the Transportation Center of the U.S. Department of Transportation, the group looked at the tire-testing laboratory and also heard about the invisible types of research going on; e.g., the assessment of various transportation systems. At the Wentworth Institute field trip, WITS took advantage of the Open House to have a specially guided tour through laboratories and other facilities most appropriate for a seventh or eighth grade math class.

Speakers were urged to bring materials—a product, a tool used in their work, or any equipment to make the presentation lively and interesting. From the responses by teachers, school staff, and students, these "hands-on" experiences were most appreciated. One firm, Prime Computer, brought a portable terminal that could be connected to a telephone outlet, and the middle-school students were able to see it in operation. Representatives from Polaroid Corporation not only demonstrated cameras, but donated one to the class. A technician from Data Instruments took apart and explained one of his company's products.

Occasionally, companies sent a team of two and even three people. For the school, this proved a great advantage since it provided a larger exposure and more "role models." Since about 41% of the speakers were women and 50% were minorities, in many cases, students had chances to identify with different people. But, in all cases, just hearing about the day-to-day work of a technician, an engineer, a computer operator, etc., clearly widens the students' comprehension of the world beyond the school room. Some speakers were college students and several teachers indicated in their comments that youngsters more easily identified with them than with older persons.

The persons addressing classes came from a variety of educational, professional, racial and ethnic backgrounds. They included women engineers, an American Indian, an MIT professor, and many others. Following are some of the terms they used to describe their roles and titles: chemist, civil engineer, design engineer, development supervisor, drafting supervisor, electric designer, employment manager, engineer, engineering student, engineering technician, field service manager, geographer, group supervisor, inspection supervisor, instrumentation specialist, iodation technician, manufacturing documentation manager, manager of graphic arts, metallurgical engineer, nuclear engineering student, personnel specialist, quality assurance engineer, radiation protection officer, research service manager, supervisor, systems analyst, technical staff member.

Student Field Trips
(Several organizations hosted more than one trip.)

Analog Devices
(Manufacturer of precision data acquisition products used in measurement and control instrumentation.)

Army Materials and Mechanics Research Center

Data General
(A computer manufacturer.)

Digital Equipment
(A computer manufacturer.)

Input-Output Computer Services
(A high-technology computer software and systems engineering company.)

Massachusetts Institute of Technology:
Graphic Arts, Nuclear Reactor, Solar House, General Guided Institute Tours

Massport: Logan Airport

Mitre Corporation
(A corporation that refines techniques of large-scale system engineering design and analysis.)

New England Telephone

Prime Computer
(A company that designs, manufactures, sells and services small and medium-size general purpose digital computer systems.)

Raytheon
(A company whose principal business is in the design, engineering, manufacturing and servicing of advanced electronic devices.)

Stone and Webster Engineering Corp.
(A consultant firm providing engineering, design and construction services.)

U.S. Department of Transportation: Transportation System Center

Wentworth Institute of Technology

Classroom Speakers

Army Corps of Engineers

Bell Laboratories

Clinical Assays
(A company involved in medical/biological research and production)

Data Instruments

Digital Equipment
(A computer manufacturer)

Draper Laboratories
(An independent, non-profit corporation dedicated to scientific research, development and education in the public interest. Its main business has been the development of inertial guidance and navigation systems for land, sea, undersea, air and space vehicles.)

Honeywell
(A company that designs, manufactures and markets a complete range of computer hardware and software systems, peripheral equipment and terminals.)

John Hancock Mutual Life Insurance Company

Massachusetts Institute of Technology: Environmental Medical Services, Students/Staff

Millipore
(A business involved in the analysis and purification of fluids.)

Mitre Corporation
(A corporation that refines techniques of large-scale system engineering, design and analysis.)

New England Nuclear
(A manufacturer of radio-active chemicals)

Polaroid Corporation
(The manufacturer of Polaroid cameras)

Prime Computer
(A company that designs, manufactures, sells and services small and medium-size general purpose digital computer systems.)

Society of Women Engineers

Stone and Webster Engineering Corporation
(A consultant firm providing engineering, design and construction services.)

The speakers reported that the eagerness of the teachers and students was very gratifying. One speaker said, "This was a delightfuly group of kids—they were alert, interested, etc. In contrast, a year ago, I spoke to a group of 10th graders at a suburban school who squirmed and talked all through my talk. I may be moving out of the area, but if I'm here, I'll do it again. Mr. "X" was a delightful teacher, and I think he'd be glad to have another speaker." And another commented, "My talk at ____ High was enjoyable as well as rewarding. The students were clearly attentive and interested in what I had to say. It was brought to my attention by the teacher that the students did well at school. My feeling was that it is preferable to speak to a small number of interested students than a large number of apathetic students. If I can be of any assistance in the future, please do not hesitate to call." Some personnel people indicated that being asked to speak by your company supervisor is for them a form of "job enrichment."

Student response to field trips was also very favorable. For example, one student said, "I think that it is fun to find out about technology because many new things are coming into the world and many people do not know about them. People don't know much about companies (and computers), but if they visit a place like Analog Devices, they will find out the facts." A teacher who accompanied the group commented, "The students appeared to be amazed at the various kinds of engineers. They asked very good questions about years of study, salary and what engineers do during a typical workday."

Based on our experience, it is hard to overemphasize the amount of detail that went into preparing for successful field trips for students: establishing dates, clearing conflicts, securing permission slips for kids to attend trips, making arrangements for bus transportation to the companies, and for luncheon arrangements as needed. Equally detailed arrangements were pursued in the case of speakers: confirming letters were sent to schools, speakers, and companies, as illustrated in Appendix C.

Teachers were urged to phone the speakers ahead of time to discuss their presentation, inform them about their classes, and get the necessary information to prepare the students. Flexibility was required in fitting the needs or desires of the target classes with the capabilities of the companies. We found, for example, that companies were less willing to sponsor visits for middle schools than for the teachers and counselors or for high-school classes. Specific dates for student field trips were, of course, individually negotiated, with special requirements of size, age level, and special interest. In planning visits and telephone conversations, the agenda for the field trip was arranged between TSCM and the hosts. Company literature was given to teachers for class discussion.

Despite all efforts, a few things went wrong at the last minute—a wayward bus, a conflict with a roller skating party, a speaker who mismarked his calendar, a teacher who never got the word, a speaker who had to be out-of-town, or who was transferred to a different job. Occasionally, also, despite the fact that teachers were supposed to phone the speakers, the youngsters were not sufficiently prepared for the event. And, on a few occasions, speakers whose qualifications sounded impeccable were not suitable: some spoke at too high a level and the class was bored; perhaps a speaker was inexperienced with young audiences or was scared. Still, in the end, WITS provided 46 classroom speakers and field trips for 31 classes, as well as the eight workshops which included participation by 75 speakers, panelists, and facilitators. As one satisfied speaker from a company said, "We whetted the appetites of some students in the technical and science area who otherwise would not have this information." The mutual satisfaction of speakers and students lays a good foundation for future collaboration.

Providing Materials and Other Services

Publications
Publications were chosen by the TSCM staff to give a representative selection of what is easy to acquire and inexpensive, to communicate that in a sense, career material is everywhere. Some of the selections were published by companies, others by government agencies, professional organizations, and universities. The use of newspapers as teaching tools was also suggested. During one workshop, a facilitator from the Massachusetts Department of Education led a discussion on the use of materials. Teachers and counselors had a chance to look over materials, to suggest how to use them, and to exchange ideas on what works for students.

Teachers and counselors selected some of the sample publications for their classes and WITS purchased the requested materials. Some teachers indicated that certain material, however useful to them, could not be used by their classes because the reading level was too high, but other teachers found the publications could be used sucessfully by their students.

The participants also received publications about each of the companies they visited on their site visits in February. In most cases, they later received other company brochures, delivered to them ahead of time by the Staff Trainer/Supervisor, so they could prepare their classes for scheduled field trips. At many of the workshops, in particular the one dealing with jobs in the public sector, representatives from the various organizations distributed literature as well. These materials spelled out details about the technological and scientific fields.

We think that the best source of straightforward factual information about occupations, industries, and projections is the annual edition of the U.S. Department of Labor, Occupational Outlook Handbook. We provided several excerpts from it. A new version for younger people called Exploring Careers was purchased by the Project for each school. These government publications not only describe occupations and the number of openings, but also explain the supply and demand situations and other variables that affect job opportunities. They are not intended to be inspirational, so other material is necessary to motivate students' interest. For local labor market information, the Massachusetts Division of Employment is a good source.

Many other materials, in fact, are derived from these basic sources but packaged more glamorously. Rather than deluge the participants, we chose some typical brief examples and typical sources of information about engineering and related careers and all participants received the material listed below:

Publications Provided by WITS for TSCM Educators

American Society of Metals
Career Development Office
Metals Park, Ohio 44073:
Introducing . . . An Exciting New World: The World of Metallurgy & Materials Engineering.

Analog Devices, Inc.
P. O. Box 280
Norwood, Massachusetts 02062
Annual Report, 1978
Analog Devices Semi-Conductor–Employee Overview
Analog Devices Semi-Conductor–Water-Fabrication
Analog Devices Semi-Conductor–Backend Assembly

Arizona Daily Star/Tucson Citizen
Tucson Newspapers, Inc.
4850 Park Avenue
Tucson, Arizona 85726:
Math Activities

Engineers Council for Professional Development
345 E. 47th Street
New York, New York 10017
After High School What?
Engineering–A Goal for Women
Industrial Engineering Technology

General Electric Company
Communications Program
Fairfield, Connecticut 06431:
Take It From Us, You Can Be An Engineer
The World of Work
What's It Like To Be An Engineer
What's It Like To Be A Technician

General Motors Corporation
Public Relations,
Detroit, Michigan 48202:
Can I Get The Job?
Drafting–Can I Get The Job?

Hewlett-Packard Company
175 Wyman Street
Waltham, Massachusetts 02154:
Hewlett-Packard: A Brief Sketch
Hewlett-Packard: In the Health Care Field

Houston Post
4747 Southwest Freeway
Houston, Texas 77001:
Using the Newspaper in the Intermediate Math Classroom

IBM
Orchard Road
Armonk, New York 10504:
Annual Report, 1978
The People and the Company

Millipore Corporation
Ashby Road
Bedford, Massachusetts 01730:
Annual Report, 1978
Dip-Test Microbiology for Food Processors
(Cat. No. AB810/P)
Microbiological Analysis of Beverages (Cat. No. AB601/U)
Preparing Sterile Particle-Free Fluids in the
Hospital Pharmacy (Cat. No. LAM3030/U)
Samplers for Monitoring Microorganisms in Liquids
(Cat. No. LMB4070/P)
Supermarket Sanitation and Monitoring
(Cat. No. PM603/U)
Testing Surface Sanitation With The Swab Test Kit
(Cat. No. PB427)

National Association of Trade & Technical Schools
2021 K Street, N.W.
Washington, D.C. 20006:
College Plus—Put Your Degree to Work with Trade
& Technical Skills
Handbook of Trade and Technical Careers and Training
How to Choose a Career. . .and a Career School
What's a Nice Girl Like You Doing in a Man's World?—
Opportunities for Women in Trade & Technical Fields

National Council of Teachers of Mathematics, Inc.
1906 Association Drive
Reston, Virginia 22091:
An Agenda for Action—Recommendations for School
Mathematics of the 1980s

National Science Teachers Association
1742 Connecticut Avenue, N.W.
Washington, D. C. 20009:
What Research Says to the Science Teacher, Mary Budd
Rowe, Editor, Stock No. 471-14758

New England Telephone Company
99 High Street
Boston, Massachusetts 02110:
After College, What?
The New England Telephone Co. Invites Minorities to Share
in the Opportunities We Offer for a Bright Future After
College

New York Times
229 W. 43rd St., 6th Floor
New York, New York 10036:
Careers in the 80's, Section 12, Sunday, Oct. 14, 1979,
New York Times

Phillips Petroleum Co.
708 Third Ave.
New York, New York 10017:
The Making of THE SEARCH FOR SOLUTIONS
The Reasons for THE SEARCH FOR SOLUTIONS

Polaroid Corporation
750 Main Street
Cambridge, Massachusetts 02139
The Polaroid Challenge

Standard Oil Co. (Indiana)
200 E. Randolph Drive
P.O. Box 5910-A
Chicago, Illinois 60680
Choices, Decisions, Actions

United States Government
Superintendent of Documents
U.S. Government Printing Office
Washinton, D.C. 20402:
Careers, United States Army Corps of Engineers
(EP 690-1-3)
Exploring Careers, U.S. Dept. of Labor, Bureau of Labor
Statistics, 1979, Bulletin 2001
Jobs for Which You Can Qualify if You're Not a High
School Graduate, U. S. Dept. of Labor, Bureau of Labor
Statistics, 1979
Jobs for Which You Probably Will Need a College
Education, U. S. Dept. of Labor, Bureau of Labor
Statistics, 1979, Stock No. 029-001-02293-0
Jobs for Which You Probably Will Need Some College or
Specialized Training, U. S. Dept. of Labor, Bureau of
Labor Statistics, 1979
Jobs for Which You Can Train Through Apprenticeship,
U. S. Dept. of Labor, Bureau of Labor Statistics, 1979,
Stock No. 029-001-02294-8
Engineering and Related Occupations, Reprinted from the
Occupational Outlook Handbook, 1978-79 Edition, U. S.
Dept. of Labor, Bureau of Labor Statistics, 1978, Bulletin
1955-20
Office Machine and Computer Occupations, Reprinted
from the Occupational Outlook Handbook, 1978-79
Edition, U. S. Dept. of Labor, Bureau of Labor Statistics,
1978, Bulletin 1955-6

United States Office of Personnel Management
Washington, D. C. 20415:
Computer Specialists, Opportunities in the Federal Government, Announcement 420, February 1977
For Starters, Federal Government Jobs that require six months of experience; a high school diploma; up to 2 years of college, vocational training or specialized work experience, BRE-78, January 1979

United States Office of Personnel Management
John W. McCormack Post Office and Courthouse
Boston, Massachusetts 02109:
New England Region Federal Job Prospects Bulletin, No. 80-2, Issued: 3/1/80, Effective Until: 4/30/80

Other Services

Teachers and counselors emphasized the importance of parental influence on their children's career choice, and it was generally agreed that schools should help the parents realize the opportunities for their children in engineering and technical fields. How to accomplish this was not so clear: Boston schools find that few parents participate in school-sponsored events. One workshop featured a speaker on parent involvement, and concern about parental support was expressed in many discussions throughout the year. In response to a TSCM questionnaire, students said what they most wanted from their parents is "Encouragement." Counselors and teachers suggested inviting parents on field trips and identifying some in technical fields to speak.

In an attempt to work directly with students and their parents, TSCM arranged for industry personnel officers to be available on a Saturday morning to counsel parents and their youngsters about technical jobs. To offer some special attractions, the meeting was held at MIT in conjunction with the Massachusetts Science Fair and the MIT Open House. A copy of the announcement of this event and the accompanying letter to teachers appears in Appendix B-10. For whatever reason, neither parents nor children chose to meet with the counseling company personnel that day.

Several times during the year some schools or teachers organized career days or other events and asked WITS to identify speakers or other resources. Whenever possible, we helped on an ad hoc basis, but given time commitments for planned TSCM activities, we were not able to do as much as we would have liked.

Getting It All Together: Educators' Recommendations

In the final June two-day workshop a considerable amount of time was set aside for the educators to meet in discussion-sized groups to formulate their evaluation of the program and make recommendations for the future. Their response was thoughtful, varied, and valuable: only a few highlights can be summarized here:

Administrative Support

"Without administrative support, I doubt I'll be able to do much in terms of careers. The heads of departments need to be involved. My being part of a team has enabled me to be continually aware—to talk about careers. I will continue to mention careers but feel there is need to keep the team going."

It was agreed by all the educators that administrative support was essential. Beyond mere endorsement of the program, an administrative mandate is often necessary to designate priorities and to permit allocation of staff and resources. Hope was expressed that there would be continued funding to build on the present momentum, encourage participants to continue school programs, and avoid losing gains made in the schools which participated this year. There was a feeling that the position of Career Coordinator should be revived in the schools: some schools have career centers which are little used because they are not staffed through lack of funds; counselor case loads need to be reduced and the significance of their roles clarified. Administrative support is also necessary to help participants continue career awareness activities to follow up on students who have had exposure to the program this year.

Staff Development

"All faculty members ideally should be involved so that they have more comprehensive understanding of the projected job market. . . .Too often, teachers operate from within their own spectrum without an appreciation of overall development of the student."

"Teachers feel isolated; there is not enough communication with other teachers or linkages with industry and higher education."

There were repeated requests for inservice workshops linking math and science with technology. Participants requested that the workshops be interdisciplinary, including math, science and industrial arts teachers and that summer internships be made available in industry for educators.

In order to address the problem of low achievement in math and science, participants recommended that there be a unified curriculum in the schools regulating scope and sequence in each math and science subject, including clear definitions of achievement expectations, and requiring a minimum of five periods per week in any math or science class.

Counselors need opportunities and strategies for motivating minority and female students to learn about the labor market and technical careers, and for developing relations between students and engineers and technicians.

Curriculum Development

In math, we need a curriculum which relates basic skill work in whole numbers, fractions, and decimals to jobs. Specifically, we need to look at careers and the specific kinds of math they use. We need filmstrips and media which explain the fields of engineering and computer science. In science, we also need to have audio-visual materials which relate the science learned in class to specific science careers."

The participants expressed the need to increase the amount of hands-on material available to students, including computers and other materials used in industry, so that classes would be more "real-world" oriented. They felt that given the rapid changes in technology their materials should be constantly updated and field-tested, that more and better quality materials should be available for the middle schools, and that there should be a directory of resource people from business and industry, including the services provided (whether equipment, brochures, speakers or site visits), and an annotated bibliography of career materials related to math and science.

It was suggested that counselors could be especially helpful in developing career bulletin boards, math and science fairs and clubs, making contacts with parents to encourage their participation, and increasing work/study opportunities for students. Counselors could help develop "big sister or brother" programs with local post-secondary students.

Collaborative Educational Planning

"It's everyone's responsibility to stimulate and encourage the students."

"It is essential to try to eliminate students' apprehension concerning math and science."

"The role of the teacher should be motivational as well as informational."

There was general consensus that positive attitudes about career options were best developed within a supportive structure of strong linkages within schools, across schools, with parents, and in community programs. Programs like WITS can pay special attention to developing and maintaining linkages. Some teachers felt that math and science teachers should be encouraged to work in teams to teach about technology. Several people suggested that math and science could be demystified if high school students explained their math and science programs, including their problems and triumphs, to younger children, and college students described and explained their programs to high-school students. It was emphasized that teachers should recognize and encourage even minor successes because competence develops confidence.

The participants felt that improvements were needed to make a stronger program of relations with industries: that the number of role models with urban roots who understand the concerns of students in Boston should be increased, and school participants should be more closely involved in the selection of speakers and site visits, which was not possible this year. Adequate in-school planning time should be available in the future for this kind of input.

Many people cited examples of the good the program had accomplished: one immediate achievement was noted by the educator who said:

"Since our participation in the WITS Program we have had three students enroll in an engineering program at Northeastern University. Several others are planning to take advanced math and science classes in the fall."

There was a general agreement that "career awareness should be a thread that teachers weave in once they learn about careers" and that "there is a great need for these services, and programs such as TSCM should continue.

Summing Up: Did We Get There from Here?

The primary question that must be asked as the term of a project comes to a close is—to what extent did the project achieve its objectives? It is our feeling that we achieved real progress in helping the selected Boston educators to arrive at a better understanding of how they might help their students to participate gainfully in this technological society. Few programs in the country have provided so many people in a single system with so much interaction with employers who sought to help in the educational system, not simply to go through whatever motions were necessary for recruiting a work force. The interaction was beneficial to both sides, but the educators, in particular, felt that to be of real value, some mechanism would have to be provided for continuing contacts.

We certainly do not delude ourselves that a small-scale operation like the WITS/TSCM project, staffed by a handful of dedicated people, run on a small budget, and funded for one year, can make a lasting difference in the overall awareness by minority students of the options for employment in science and technology. Given the huge social inequalities in housing and income, the educational pressure for minimum competence, an uncertain economy and its impact upon schools, how much can be expected? Certainly the TSCM program could address only a piece of a much larger societal situation. We did not escape these larger issues—in some ways TSCM was a microcosm of social conflicts that surfaced in myriad ways throughout the program and could have destroyed it but did not. Some of these conflicts are worth mentioning because we think they might be faced by any other mixed group in a common effort.

There were inevitable differences in work assumptions and style between the universities and the Boston schools. To educators in the Boston schools, academic institutions can look like playgrounds for people philosophizing about education and social problems without having to come out of their ivory towers. To academics who take a great degree of institutional freedom as a matter of course, the regulations of a large urban school system requiring detailed accountability for time and procedures, connote an unacceptable lack of trust of employees. For example, it came as a shock to some university faculty to hear that Boston educators had to sign time sheets upon arrival and departure from workshops and expected to leave exactly on schedule.

Educators and employers are also sometimes skeptical about each other. Educators sometimes think that employers would be satisfied with any level of education, however narrow, as long as it could supply them with an adequate work force. They also feel that employers push tax reduction at the same time as they expect schools with financial and personnel problems to do a better job. Employers, on the other hand, feel that schools aren't part of their "real world" and are unwilling or unable to communicate the work ethic or to develop competence. But, as one administrator said at the end of the school year, "WITS shattered a myth—that companies are not willing to come to the aid of schools and that schools won't use their resources. Now I know that is not true."

Another difference in perception surfaced within the MIT/WITS family when one of our educational consultants expressed a concern she shared with some other minority people: "At issue in the implementation of any program for a targeted group is the question whether or not the affected group is involved in project management. In this program they were not."

Although the leadership of WITS, which existed prior to undertaking the TSCM program, is white, it was recognized that minorities should have significant project roles, and minority people, both male and female, were recruited as speakers and consultants throughout the year. We deliberately asked whites as well as minorities to contribute to all activities not only because we think it unfair to

exclude those whites who share interest in developing the resources of all people, but also because employers are inclined to overburden minority employees with community and educational activities. It is also important in a democratic society for young people to see that minorities and whites share concern about opportunities for youth and that they can work together. We believe that the WITS staff should build upon relationships with minority-managed organizations who shared in the TSCM program to aid them in expanding access to resources for their own efforts on behalf of Boston minority youth. Such an implicit commitment was made at the close of the year, and we expect to meet with representatives of minority programs which similarly seek to assist minority students in the Boston schools.

This accounting has permitted us to reflect on a difficult but rewarding effort. If we have learned anything from our experience, it is that there are no quick and easy solutions to a problem as complex as widening students' perceptions of what work they may want to do and what they must learn to do it. One cannot create career awareness for any group in the schools simply by furnishing teachers and counselors with a list of resources: the person who was a splendid role model when living in Sudbury may now have moved to Silicon Valley. Contacts must be made and followed up individually, repeatedly, and with good humor.

Fortunately, this is a game that any number can play. In this brochure, we have deliberately included "the troubles we've seen" but also, we hope, the joy and dedication of many people who participated with us in linking education and work in practical ways. We hope this report will be useful to TSCM participants as they struggle with implementation, to those who funded TSCM and others who fund similar programs, and to people in companies, colleges, and community agencies who might play similar catalytic roles in developing human resources in our technological society.

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*This form was also sent out with C-1
**A similar set of forms and memos was used for field trip confirmations.
***Similar Thank You letters and questionnaires were sent to field trip organizers and workshop participants.

Appendix A-1

LIST OF TSCM PARTICIPANTS

Explanation of abbreviations:
T.A. = Team Administrator
(One of the team members was selected as the Team Administrator.)
G.C. = Guidance Counselor
Math = Math Teacher
Science = Science Teacher

BOSTON LATIN SCHOOL

Principal : Michael Contompasis
T.A.: Stacy Johnson
G.C.: Kevin Bowers
Math: Edith Walker
Science: Robert Akeson

CATHEDRAL HIGH SCHOOL

Principal: Sister Nancy Roache
T.A.: Elizabeth Feser
G.C.: Leo Hogan
Math: Richard Thoen
Brother Stephen Wang

CLEVELAND MIDDLE SCHOOL

Principal: F. Robert Lyons
T.A.: F. Robert Lyons
G.C.: William Burke
Iris Husbands
Math: Joseph Pokaski
Science: Kenneth Kaplan

DORCHESTER HIGH SCHOOL

Principal: Edward C. Lambert
T.A.: Anthony Dileso
G.C.: Jacqueline Murray
Math: John Holmes
Science: Yvonne Phillips

HYDE PARK HIGH SCHOOL

Principal: Michael A. Donato
T.A.: Ruth O'Day
G.C.: John Craven
Math: Gerard Quinn
Science: Adelle Jones

IRVING MIDDLE SCHOOL

Principal: Richard J. Maloney
T.A.: Richard J. Maloney
G.C.: Phyllis Coughlin
William McDougall
Math: Mel Campbell
Science: John Sheridan

KING MIDDLE SCHOOL

Principal: Will Ella Brown
T.A.: Robert Dever
G.C.: Paul Connell
Math: Ocie Sydnor
Science: Robert Brown

LEWIS MIDDLE SCHOOL

Principal: George A. Johnson
T.A.: Joseph Sullivan
G.C.: Marilyn Stevens
Math: David Thweatt
Science: William Robinson

MADISON PARK HIGH SCHOOL

Principal: Thomas P. Hennessey
T.A.: Melvin Simms
G.C.: Thomas Gilarde
Roberta O'Leary
Math: Patricia Tremblay
Science: Winnifred Conroy

MCCORMACK MIDDLE SCHOOL

Principal: John D. Callahan
T.A.: Leonard Epstein
G.C.: Estelle Hector & Joseph Ford
Math: Patricia Artis
Science: R. Christine Jordan

MICHELANGELO MIDDLE SCHOOL

Principal: John P. Breen
T.A.: John Mullen
G.C.: Salvatore Cacciola
Math: Leo Lew
Science: William Marshall

MISSION CHURCH HIGH SCHOOL

Principal: Sr. Jacqueline Colabe
T.A.: Sr. Eileen Shea
G.C.: Margaret Tampone
Math: Sr. Eileen Reilly
Science: Joseph Fillmore

ROOSEVELT MIDDLE SCHOOL

Principal: Clifford Janey
T.A.: Clifford Janey
G.C.: Paul Clancy
Math: Richard Stutman
Science: Northa Lee Lewis

TAFT MIDDLE SCHOOL

Principal: Michael Fung
T.A.: Michael Fung
G.C.: Luco LaCambria
Math: Ruthann Seck
Science: Janet Ellis

THOMPSON MIDDLE SCHOOL

Principal: Gerald Hill
T.A.: Gerald Hill
G.C.: Ivy Beckles & Janet Owens
Math: John Bunker
Science: David Donato

UMANA TECHNICAL HARBOR SCHOOL

Principal: Gustave Anglin
T.A.: Paul DeLorie
G.C.: Cora Ott
Math: Paula Barton
Science: E. Jeanette Burns

Appendix A-2

INDUSTRY AND OTHER
ORGANIZATIONS PARTICIPATING IN THE TSCM PROGRAM 1979-80

Organizations	Field Trips For Students	Site Visits For Educators	Speakers For Schools	Speaker/Moderator Participants at Teacher Workshops
Action for Boston Community Development (ABCD)				X
Analog Devices	X	X		
Army Boston District Command				X
Army Corps of Engineers			X	X
Army Materials & Mechanics Research Center	X			X
Army Natick Research Center				X
Bell Laboratories			X	
Brandeis University				X
Clinical Assays			X	
Data General Corp.	X			
Data Instruments			X	
Digital Equipment Corp.	X		X	
Draper Laboratory, Inc.			X	
Governor's State Youth Council				X
Factory Mutual Engineering				X
G.T.E. Sylvania				X
Greater Lawrence Regional Technical School				X
Hanscom Air Force Base				X
Hewlett Packard		X		
Honeywell			X	X
Input-Output Computer	X			
John Hancock Mutual Life Insurance Co.			X	
Malden High School				X
Massachusetts Department of Education				X
Mass. Dept. of Environmental Quality Engineering				X
Mass. Division of Employment Security				X
Massachusetts Institute of Technology:				
Graphic Arts	X			
Nuclear Reactor Laboratory	X	X		
Personnel Office				X
Solar House	X			
Students/Staff			X	X
Computer Graphics		X		
Arteriosclerosis Center		X		
Energy Lab		X		
Environmental Medical Services		X		
Word Processing Center		X		
MassPep				X
Massport				X
Millipore		X	X	
Mitre Corp.	X		X	X
New England Nuclear Corp.			X	
New England Telephone Co.	X		X	
Northeastern University*				X
Polaroid		X	X	
Prime Computer	X		X	X
Raytheon	X			
Society for Women Engineers			X	
Stone & Webster	X		X	
Tri-Lateral Council for Quality Education				X
Urban League of Eastern Mass.				X
U. S. Food & Drug Administration				X
U. S. Transportation Systems Research Center	X			
University of Massachusetts				X
Wang Laboratories				X
Wentworth Institute*	X			
Y.E.S. Program				X

* Hosted a Teachers' Workshop

Appendix A-3

TSCM Advisory Group on Organizational Participation

Name	Organization
Marianne Abrams	Tri-Lateral Council for Quality Education
David C. Blackman	Northeastern University
Robert Borden	State Advisory Council on Vocational-Technical Education
Regina Clifton	Boston public school parent
Sally Cortese	Digital Equipment Corp.; President, Boston; Section Society of Women Engineers
Michael Feld	Massachusetts Institute of Technology;
William S. Gale	Gillette Company
Joyce Grant	Boston Public Schools—Office of Planning and Policy
Frank Hazel	Mitre Corporation
Verniece Hensey	Mitre Corporation
Clara Hicks	Boston Public Schools—Curriculum Advisor
Hattie B. McKinnis	City Wide Advisory Committee—B.P.S. ESAA
Michael Odom	Digital Equipment Corporation
E.R. Pariser	Massachusetts Institute of Technology
Sally Patton	Department of Manpower Development
Byron Ricketts	Raytheon Company

Appendix A-4

Statistical Summary of Workshop Panelists/Facilitators

	Male Number	Male Percent	Female Number	Female Percent	Total Number	Total Percent
Black and other minorities	30	61%	12	46%	42	56%
White	19	39%	14	54%	33	44%
Total	**49**	**100%**	**26**	**100%**	**75**	**100%**

Statistical Summary of Speakers at Schools

	Male Number	Male Percent	Female Number	Female Percent	Total Number	Total Percent
Black and other minorities	15	55%	8	42%	23	50%
White	12	45%	11	58%	23	50%
Total	**27**	**100%**	**19**	**100%**	**46**	**100%**

Appendix A-5

Students in Target Classes, Race and Number

	Race and Number of Target Students			
	Black	White	Other	Total
Boston Latin School	30	4	3	37
Cathedral High School	16	7	10	33
Cleveland Middle School	30	22	6	58
Dorchester High School	29	6	2	37
Hyde Park High School	30	7	0	37
Irving Middle School	23	17	2	42
King Middle School	29	18	5	52
Lewis Middle School	23	18	2	43
Madison Park High School	18	22	10	50
McCormack Middle School	17	20	21	58
Michelangelo Middle School	14	12	34	60
Mission Church High School	11	29	1	41
Roosevelt Middle School	22	13	17	52
Taft Middle School	32	8	14	54
Thompson Middle School	48	16	1	65
Umana Technical Harbor School	18	18	10	46
Totals	**390**	**237**	**138**	**765**

Appendix B-1

APPENDIX B-1

PERSONNEL CIRCULAR

Boston Public Schools

No. 12, 1979-1980
October 11, 1979

WORKSHOPS FOR MIDDLE AND HIGH SCHOOL MATH AND SCIENCE

TEACHERS, GUIDANCE COUNSELORS AND ADMINISTRATORS

To Community Superintendents, Headmasters, Principals and other Administrative Heads:

Headmasters, Principals and other Administrative Heads are requested to keep on file a DATED CHECK LIST signed by all academic personnel under their jurisdiction as evidence that each has read this circular.

GENERAL INFORMATION: Project TSCM:

The Emergency School Aid Act (ESAA) of the Boston Public Schools and Massachusetts Institute of Technology/Work in Technology and Science (WITS) has received funding for the Technology and Science Careers for Minorities (TSCM) component for the 1979-80 school year.

PURPOSE: To provide training for teachers, counselors and administrators to aid them in developing strategies for expanding minority student awareness of technology and science careers through the design of instructional activities which inform them of the practical applications of math and science.

PARTICIPANTS: A total of 15 Boston middle and high schools will be selected to participate in the Project. All middle schools in Districts 1, 2, 3, 4, 5, 6, 7, 9 and all high schools are eligible to participate. Each school will be represented by 1 math teacher, 1 science teacher, 1 guidance counselor and 1 administrator. Five of the fifteen schools will be able to have two guidance counselors on the team.

WORKSHOPS: The workshop schedule is as follows: (Some of these will be job site visits)

Teachers and Counselors		Administrators	
November 14	4-7 p.m.	November 14	4-7 p.m.
December 15	9-3 p.m.	Feb. 19, 20,21	9-3 p.m. (choose one)
January 19	9-3 p.m.	March 19	4-7 p.m.
Feb. 19, 20, 21	9-3 p.m. (choose one)	April 9	4-7 p.m.
March 19	4-7 p.m.	May 14	4-7 p.m.
April 9	4-7 p.m.	June 23, 24*	9-3 p.m. (2 days)
May 14	4-7 p.m.		
June 23, 24*	9-3 p.m. (2 days)		

Compensation will be in accordance with the current collective bargaining agreements. First workshop, November 14, 1979, will be held at the Campbell Resource Center.

*Date assumes that June 20 is last day of school.

(over)

ACTIVITIES: The workshops will provide opportunities for personal interaction with people working in technology and science. The orientation to careers and implementation ideas will aid schools in orienting students to the work world. Material presented will suggest career options for students with varying interests, abilities and educational interests.

1. Workshops: Areas covered will include labor market orientation, resource materials, professional organizations, publications, programs serving minorities, labor unions, site visits (training programs, etc.), speakers from industry, role models, applications of math and science, career awareness in science and technology, instructional strategies, resource identification.

2. In-School: School team members will develop activities for students based upon workshops. One job-site field trip per school may be provided, and funds will be available to purchase technology and science career related curriculum materials for each school. Participating teachers will also receive a roster of people from related industries who will be available to deliver presentations and demonstrations to their students. Also, Hubert Humphrey Resource Center cluster planners will be able to provide technical assistance.

REQUIREMENTS: Approval of Headmaster or Principal for delivery of TSCM curriculum to your students.

PERFORMANCE RESPONSIBILITIES:

Teacher participants in the TSCM Project will be expected to:

1. Attend workshops.
2. Administer pre-post tests to their students (at least one class) in or related to awareness of technology and science careers. Test will take less than 30 minutes.
3. Incorporate into their lessons the materials and ideas obtained at training workshops.
4. Plan to involve persons in technology and science careers, including minorities, as guest speakers to discuss career options with students (with Headmaster and teacher approval).

Counselor participants in the TSCM Project will be expected to:

1. Attend workshops.
2. Communicate regularly with team members to identify students for counseling with respect to technology and science careers and, for high schools, related elective courses, and cooperate with teachers in planning career related activities.

Administrator participants in the TSCM Project will be expected to:

1. Attend workshops.
2. Gain knowledge of the TSCM program, and, as much as possible, facilitate the project reaching its goals/objectives.

PREFERRED QUALIFICATIONS:

1. Interest in providing technology and science career information to your students.
2. Flexibility in your teaching style to incorporate gained ideas, information, curriculum.
3. Willingness to allow a guest speaker(s) to address your class.
4. Special concern about how to encourage minority students to prepare for careers in science and technology.

APPLICATION PROCEDURE:

Math and science teachers, guidance counselors and administrators (when not Headmaster/Principal) should apply to their Headmaster/Principal in writing by October 31, 1979. Headmaster/Principal will then select participants from his/her school and complete the attached application form. Each interested school will submit an application with 1 math teacher, 1 science teacher, at least 1 guidance counselor (maximum of 2 - ranked in order) and 1 administrator as a team for the Project. Schools with less than a full team will be considered for participation after schools with complete teams. Headmasters and Principals are asked to make every effort to insure balanced race and sex representation on each team.

SELECTION OF SCHOOLS:

Final selection of participating schools will be made by the TSCM staff in conjunction with the Department of Curriculum and Competency, Boston Public Schools.

Headmasters and Principals of interested schools should forward the attached application form to Richard Deveney, Coordinator, TSCM Component, ESAA Office, 26 Court Street, Boston, MA 02108 by November 5, 1979. All applications will be acknowledged in writing.

The recruitment, selection and assignment policies and procedures of the Boston Public Schools are covered by federal and state non-discrimination laws, by federal court orders and by affirmative action policy of the Boston School Committee. Questions regarding recruitment should be addressed to the Office of Personnel Recruitment, 726-6592. Questions regarding assignment should be addressed to the Office of Equal Opportunity, 726-6364.

FOR FURTHER INFORMATION, PLEASE CONTACT RICHARD DEVENEY, ESAA COORDINATOR, 26 COURT ST., BOSTON, MA 02108, Telephone 726-6525.

CLARENCE COOPER
Director of Personnel Management

Attachment

Response to PERSONNEL CIRCULAR NO. 12, 1979-1980
October 11, 1979

Richard Deveney, Coordinator
ESAA Office
26 Court Street
Boston, MA 02108

APPLICATION FOR PARTICIPATION IN

TECHNOLOGY AND SCIENCE CAREERS FOR MINORITIES

_____ _____
(School) (Date)

The following math and science teachers, guidance counselor(s) and administrator have been selected to apply to participate in the TSCM Project. Teachers, counselors and administrators agree to implement the performance responsibilities as indicated in this circular.

Signature	Race	Sex	Courses now teaching & grade level where applicable
_____ Math Teacher	___	___	_____
_____ Science Teacher	___	___	_____
_____ Guidance Counselor (1st Selection)	___	___	
_____ Guidance Counselor (2nd Selection)	___	___	: This counselor may not be allowed to participate. Schools will be notified.
_____ Administrator	___	___	_____ Rank (If teaching, courses only)

I agree to allow the math and science teachers to incorporate some technology and science career awareness curriculum into their courses.

_____
Headmaster/Principal
(Signature)

Appendix B-2

TEACHERS

Your input is essential for planning the TSCM program and to make the workshops as interesting and useful as possible. So we can help you, please help us by giving us realistic and complete answers. Feel free to continue your answers and to add comments on the extra sheet. Some of the data will be utilized also for project evaluation. Your personal identifying information is necessary for payroll purposes. We realize that everyone's time is limited, and to minimize the paper work, we have consolidated all the information in one form. Please return this form in the attached envelope by November 21. WE DO APPRECIATE YOUR COOPERATION!

Name_____ School_____

Home Address_____ School Address_____

Home Phone_____ School Phone_____

Social Security Number_____ Race_____ Sex_____

Times available for occasional meetings with Richard Deveney:

	Specify Times of Day
Monday	
Tuesday	
Wednesday	
Thursday	
Friday	

What courses do you teach? (Please specify titles, grade levels and number of classes.)

_____

Approximately how many students do you teach per school day?

	White	Black	Other Minority
Male			
Female			

DURING THE COURSE OF THE 1978-79 SCHOOL YEAR:

1. In how many class sessions, if any, did you include career awareness activities, curriculum or materials?

   None_____ 1-4_____ 5 or more_____

   Approximately how much time did you spend during the year conducting these activities?

   Less than 3 hours_____ 3-10 hours_____ Over 10 hours_____

   If you have conducted such activities, please give examples._____

   _____

   _____

   _____

2. Did you take your classes on one or more field trip(s)? No__Yes__.If yes, how many?_____

   Purpose and location of field trip(s)._____

   _____

   _____

   What would you like to see done in the future to facilitate a field trip for a math or a science class?_____

   _____

   _____

3. Have you had speakers address your classes? No___ Yes___. If yes, how many times?_____. Please explain briefly how you arranged for the speakers, the subject matter, the speaker's title and affiliation, and what you thought of the impact on students._____

4. What career materials, if any, have you used in your math or science classes? None____ If you have used career materials, please give a few of the best name(s) and source(s).

5. Related to careers, which of the following have you obtained from a school counselor?

   Nothing_____ Career Materials_____ Other Information (Pls. specify)_____

6. How frequently have you discussed career related issues with:

	Number of Times			
	Never	1-4	5+	Pls. comment on the nature of the discussion.
...an individual student				
...a school administrator				
...your department head				
...a guidance counselor				
...a career educator				
...a school librarian				
...another teacher				
...a parent				

7. Have you used a Career Information Center? No___ Yes___. If you have used it, please explain in detail how often, for what students, etc._____

GENERAL INFORMATION:

8. Is your school paired with a business firm or university? No___ Yes___. If yes, what firm?_____. What university?_____. Has this pairing been of use to you or your students? No___ Yes___. If yes, please explain how.

9. What community resources (e.g., Boston Volunteers, Jobs for Youth, etc.) are available to your school to assist you in planning career related activities? If you have used them, please explain how._____

10. Have you heard of the Massachusetts Occupational Information System (MOIS)? No___ Yes__
Have you used it? No___ Yes___. Please comment._____

11. Please describe briefly your participation in the following during the last three years:

Please specify subject matter, sponsoring institution, etc.

in-service programs_____

courses_____

professional meetings_____

12. Please describe briefly ways (e.g., work experience, T.V., reading, relatives, friends, college courses, YMCA or YWCA, etc.) that have informed you about:

...careers in technology and science_____

...minority issues_____

13. What limits your capacity to implement activities related to careers in your classroom?

14. What would you like to learn about careers in technology and science this year?

15. What do you think can/should be done to encourage middle and/or high school students to pursue math, science and technical courses?

16. Please suggest ways to involve parents in meeting the objectives of this year's program.

Thank you for your cooperation!!!

Appendix B-3

TEACHERS' QUESTIONNAIRE SUMMARY (22)

What limits your capacities to implement activities related to careers in your classroom?

8-time
6-career materials on science/technology
5-own lack of knowledge
3-student motivation
1-math & science phobia
1-class size
1-no AV equipment
1-disorder & confusion
1-students not thinking at all about careers (9th grade)
1-students have career ed twice a week-don't like it in class
1-space

Quote: "avoid assemblies."

What would you like to learn about careers in technology and science?

9-skills needed
6-job descriptions
5-job outlook
4-motivation process
2-financial aid available
2-guest speaker available
2-information sources
1-information on use of algebra, calculus, trigonometry to explain to middle school students
1-how to use them to motivate students
1-nothing in particular
1-eliminate phobia
1-evaluate test results
1-financial benefits
1-how employees are evaluated
1-on-the-job training

What do you think can be done to encourage students to pursue math, science & tech. careers?

3-hands-on experiences
3-role models
2-build interest
2-inform them
2-make math fun
1-part-time job
1-present practical nature of math/science
1-guest speakers
1-field trips
1-do all possible
1-illustrate requirements to get jobs
1-discuss future technological changes
1-good communication (family-students)
1-no theoretical math&science until high school

Quote: "Realistically only students that have measured success in math and science can be expected to pursue a rigorous course of study in such subjects."

Please suggest ways to involve parents in meeting the objectives of this year's program.

5-parents as guest speakers (survey them & find if any are in tech. fields)
4-chaperones - field trips
4-pay
2-make parents go on field trips
2-inform them
2-REPC
2-invite to school to hear speakers
2-Brochure on jobs
1-newsletter
1-parent group
1-churches
1-career day
1-school activities

Appendix B-4 Letter to Math and Science Teachers About Target Classes

wits MIT Project on Work in Technology and Science
Room 20C-228 Massachusetts Institute of Technology
Cambridge Massachusetts 02139
Telephone 617-253-7378

Dear Math and Science Teachers:

We would like to use this questionnaire as an opportunity to explain this year's program to the students in your "target class". We would like to convey several ideas to your students: we would like them to know that the project is an effort to help them to think about their own futures, and that the choices they make in school do have real impact on their lives as they make career choices. We hope that the speakers from industry and the field trips will convey to students what technical and scientific careers are all about, and why skills in science and math become increasingly important with the development of modern technology. We want to convey to your students that technical and scientific careers can be real and viable options for them, and that these careers tend to require some exposure to academic material in science and math.

The results of this questionnaire could be used as a basis for some class discussion about careers, and, more specifically, student attitudes about careers which deal with science and technology. We've thought about some possible topics for discussion which we hope will be useful for you in the classroom. First, what jobs do your students think they might want to be doing in the future? How much education do they think is required for these jobs? How much do they actually know about available jobs? Second, how do students think that their counselor could assist them in preparing for their eventual career? (It may be helpful to involve the counselor on your team in this discussion). Third, what "type" of person do students think are involved in scientific and technological careers: "brainy-types"? Men only? Or do they think that <u>everyone</u> can gain employment in these jobs? Do they think that the opportunities are equal for women, blacks, Hispanics? Fourth, would any of your students like to make any specific suggestions for you to share with us concerning this year's program? Fifth, what courses do students think are important to take when preparing for careers in science and technology? Sixth, do your students think that a mathematician does math <u>exclusively</u>? Does a scientist perform experiments and do nothing else? What skills <u>besides</u> math and science skills are necessary to effectively perform jobs in science and technology?

We hope that your class discussions and the results of the questionnaire will help you become more familiar with your students' career interests and with their ideas, their aspirations, their expectations. We would also like to encourage you to advise us of your particular needs and your ideas as we recruit speakers and arrange site visits with our industry friends.

Merry Christmas! Happy New Year!
- The WITS Staff -

Appendix B-5

wits MIT Project on Work in Technology and Science
Room 20C-228 Massachusetts Institute of Technology
Cambridge Massachusetts 02139
Telephone 617-253-7378

Return of Pre-Test - Richard Deveney will pick up the Pre-Test results from you at your school beginning 1/10/79. Please try to have them completed then.

"Target Class" Composition

1. Composition of target class:

	White	Black	Other
Male			
Female			

2. What time of day does this class meet?

time of day	M	T	W	Th	F

3. To help us in planning our program, please comment on your target class:

Name of course: _____

Topics covered in class: _____

Reasons for choosing this class: (such as; class behavior, ability level, motivation, special interests of students, etc.)

_____

_____

_____

_____

_____

_____

4. How many of the students in your target class are also in the other target class in your school? _____

5. Might it be possible to plan **simultaneous** programs for both target classes? ___Yes ___No Please comment on how this might be arranged.

_____

_____

Appendix B-6

TECHNOLOGY AND SCIENCE CAREERS FOR MINORITIES WORKSHOP: November 14, 1979

EXPLANATION OF PAYMENT:

Participants will be paid in accordance with MIT Accounting Office procedures in February and in June. No taxes will be deducted from your check, but you will be expected to report your income to the IRS. Any questions concerning payment should be referred to Jennifer Porter at Project WITS.

SITE VISITS FOR EDUCATORS AND STUDENTS - SCHOOL VISITS BY INDUSTRY PERSONNEL:

In cooperation with technical and scientific industries, WITS staff is planning to provide site visits in a variety of organizations in the greater Boston area.

WITS is also establishing a roster of names of persons working in many technical and scientific jobs who will come to a school. A speaker, in some cases a team, will be available a few times between February and June to talk to math and science classes. More information regarding site visits and speakers will be provided at the next workshop and a complete schedule will be ready in January. If you have any questions regarding these events, please call Nadine Rodwin at Project WITS.

HOMEWORK! Please complete the questionnaire and return it to the WITS office before November 21. An addressed and stamped envelope is enclosed.

AGENDA:

4:00 to 4:10 p.m.	Sign in.
4:10 p.m.	Edith Ruina, Director, Project WITS Richard Deveney, ESAA Coordinator
4:25 p.m.	Welcome from the office of the Superintendent of Boston Public Schools
4:35 p.m.	Arthur E. Carter, Honeywell, Manager of Equal Employment Opportunity and Employee & Community Relations Programs
5:00 to 6:30 p.m.	Workshops in small groups. Dr. Strickland and group facilitators
6:30 to 7:00 p.m.	Report of small groups and general discussion

Appendix B-7

TSCM WORKSHOP EVALUATION

TO: TSCM PARTICIPANTS

Please help us help you by letting us know your reactions to the workshops so far!

Please check one of the following:

Math Teacher_____ Science Teacher_____ Guidance Counselor_____

	Please check: Excellent	Valuable	Slightly Valuable	Not Valuable
Workshop #1-Nov. 14, 1979-Campbell Resource Center:				
Arthur Carter, Honeywell-speaker on minorities	____	____	____	____
Strickland, et al-discussions of student motivation	____	____	____	____
Workshop #2-Dec. 15, 1979-Wentworth Institute:				
Panel of minority role models	____	____	____	____
Norma Clarke on Mitre/Madison Park H.S.	____	____	____	____
Wentworth President's talk on nature of engineering related careers	____	____	____	____
Wentworth Admission Officer	____	____	____	____
Small group discussion of why Boston minorities don't participate in technology and science	____	____	____	____
Meeting with your school team	____	____	____	____
Workshop #3-Jan. 19, 1980-Northeastern University				
F. Williams Sarles' talk on "What an Engineer Does"	____	____	____	____
Mary Kay Tetreault-use of career materials	____	____	____	____
Northeastern presentation	____	____	____	____
Meeting with your school team	____	____	____	____

What have you liked *most* about workshops so far?_____

_____

_____

What have you liked *least* about workshops so far?_____

_____

_____

What are your suggestions/comments re future workshops?_____

_____

_____

THANKS!

THE WITS STAFF *1/19/80*

TO: TSCM PARTICIPANTS

Please help us help you by letting us know your reactions to TSCM workshops and activities conducted so far!

Name_____ School_____

Site Visits (Please rate only yours):	Please check: Excellent	Valuable	Slightly Valuable	Not Valuable
Polaroid	_____	_____	_____	_____
Analog Devices	_____	_____	_____	_____
Millipore Corporation	_____	_____	_____	_____
Hewlett Packard	_____	_____	_____	_____

As a result of your site visit, is your attitude about working in technological fields:

more positive _____

more negative _____

unchanged (I continue to see advantages) _____

unchanged (I continue to see problems) _____

Feel free to explain your responses on the other side of the page.

What could be done by WITS to improve future site visits for teachers?_____

_____

_____

What could be done by industry to improve future site visits for teachers?_____

_____

_____

Have your students had a speaker? YES___ NO___ field trip? YES___ NO___

Speaker(s)/Name of Industry	Field Trip/Name of Industry
1._____	_____
2._____	

Rate students' response:

Speaker: POSITIVE 10 9 8 7 6 5 4 3 2 1 NEGATIVE

Field Trip: POSITIVE 10 9 8 7 6 5 4 3 2 1 NEGATIVE

How did/will you prepare students for a speaker or field trip?_____

_____

_____

What kind of follow-up did/will you have?_____

_____

_____

How many times has your TSCM team met formally or informally?

0 1 2 3 4 5 or more

Please describe any hands-on materials you have used to help students understand technology.

_____

_____

Are there other resources you have found helpful? Please describe._____

_____

_____

Please indicate how you have used the materials you have received in this program.

class discussions _____
homework assignments _____
leisure reading _____
special projects _____
(Please describe) _____
_____
_____

informal counseling _____
a. individual _____
b. group sessions _____
formal counseling _____
planning with the TSCM team _____

	Excellent	Valuable	Slightly Valuable	Not Valuable
Workshop #4 - March 19, 1980 - MIT:				
Group discussion on implementation strategies	_____	_____	_____	_____
Panel on computer-related careers	_____	_____	_____	_____

What did you like *most* about the workshop?_____

_____

_____

_____

What did you like *least* about the workshop?_____

_____

_____

_____

*Additional comments/suggestions:*_____

_____

_____

_____

_____

4/9/80

Appendix B-8.1 School Team Memo re Need for Evaluating Year's Program

wits MIT Project on Work in Technology and Science

Room 20C-228 Massachusetts Institute of Technology

Cambridge Massachusetts 02139

Telephone 617-253-7378

TO: TSCM SCHOOL TEAM

We do not know whether this or any other career exploration program will be available next year. However, if one is available, it would be valuable to have feedback from the participants in this year's TSCM program. If no formal program is available, there may still be things that individuals or schools could pursue.

Based upon your experiences this year, we ask your school TSCM members to discuss the questions attached as they relate to your school. One member of your group should summarize the group's thinking on the buff-colored sheets.

Please read all of the questions aloud before beginning discussion so that you can decide in what sequence people would like to discuss them. We hope that you will be able to cover most of them, but your team may want to select some questions for longer discussion.

We plan to review all of the school responses to use in planning the June meeting.

Thank you for your cooperation!

May 14, 1980

Appendix B-8.2

INSTRUCTIONS FOR RECORDING YOUR TEAM'S DISCUSSION

Please record your team's responses in as much detail as possible. A separate sheet is included for each question.

PLEASE RETURN TO RICHARD DEVENEY BEFORE YOU LEAVE THIS EVENING.

1. If a similar program were available next year, would you like to continue participating in it? Why or why not?
2. Is it important to take time from regular curriculum to focus on career exploration? Why or why not?
3. What other staff members in your school could/should be involved? Why?
4. Does this program lend itself better to math or science teachers, counselors or administrators?
5. Can you suggest ways of relating career development to: language arts, social studies, art or other subjects?
6. Can you suggest ways of cooperating with other schools?
7. Can you suggest how a program like TSCM can be made more useful to your school?
8. If planning time were available at your school: a.) who should be involved; b.) what is the best time; c.) what types of things should be discussed; d.) how should the planning process be structured?
9. What specific curriculum related to math and science would you like to have available to promote career development?
10. How can counseling/guidance at your school encourage students to prepare for technical and scientific careers?
11. Assuming that you are not part of a TSCM program next year, what specific career awareness activities will be conducted at your school?

Name_____ *5/14/80 WORKSHOP*

School_____

Name of Discussion Leader_____

Appendix B-9.1

wits MIT Project on Work in Technology and Science

Room 20C-228 Massachusetts Institute of Technology

Cambridge Massachusetts 02139

Telephone 617-253-7378

NAME_____ SUBJECT_____ DATE_____

Dear Student:

We are asking you to help us think about what might help you or other students learn about careers in the technological fields. You have had some speakers, some printed materials and a field trip to an industry. We want to know what students think is useful for them. Thank you for your cooperation!

Please circle your rating of each speaker and field trip. 10 means TERRIFIC, 1 means BAD NEWS.

Speaker #1 _____ 10 9 8 7 6 5 4 3 2 1
(name & company)

Speaker #2_____ 10 9 8 7 6 5 4 3 2 1
(name & company)

Field Trip_____ 10 9 8 7 6 5 4 3 2 1
(company name)

1. Say one or two things you found particularly new or interesting in the above._____

_____

_____

2. What have you read about careers in technology this year? Please name or describe._____

_____

_____

3. What subjects do you think it is important to take if you want a job in a high technology company?_____

4. Do you think you have a better idea now about what technicians, engineers and scientists do than you had before this school year? Much Better_____ A Little Better_____ Same____

5. What do you think all students ought to learn about careers in technology? _____

_____

_____

6. What would you like each of the following to do to help you next year to think about your future career?

   Math Teacher_____

   Science Teacher_____

   Counselor_____

   Parent(s) or Guardian_____

7. Improving technology means making things work better. Can you give examples of technology you would like to understand more or to improve?_____

_____

_____

Do you have some special thoughts ???
See other side

Appendix B-9.2

wits MIT Project on Work in Technology and Science

Room 20C-228 Massachusetts Institute of Technology

Cambridge Massachusetts 02139

Telephone 617-253-7378

Dear Math and Science Teachers:

Many of you have wanted to have a better sense of student reactions to speakers, field trips and materials. At the very least, WITS also wants to take advantage of the TSCM program to involve you in recommending what ought to be done based upon your students' and your reactions this year. Therefore, we ask you to:

1.) *have the students in the TSCM target class complete the questionnaire that we have prepared---be sure to remind students of names of speakers and companies to write in on their forms;*

2.) *summarize their responses on this form and return your summary in the self-addressed stamped envelope;*

3.) *put the student forms back in the envelope in which you received them and bring them to the June meeting as a basis for further discussion.*

Thank you for your cooperation!

Name of Teacher_____

Subject_____

No. of Students Responding_____

Date_____

NUMBER OF STUDENTS FOR EACH RATING

	10	9	8	7	6	5	4	3	2	1
Speaker #1										
Speaker #2										
Field Trip										

PLEASE SUMMARIZE THE STUDENTS' ANSWERS TO QUESTIONS.

1. Say one or two things you found particularly new or interesting in the above:_____

_____

_____

_____

_____

_____

_____

2. What have you read about careers in technology this year? Please name or describe:_____

_____

_____

3. What subjects do you think it is important to take if you want a job in a high technology company?_____

_____

4. Do you think you have a better idea now about what technicians, engineers and scientists do than you had before this school year? (Please indicate how many responses.)
Much Better_____ A Little Better_____ Same_____

5. What do you think all students ought to learn about careers in technology?_____

_____

_____

_____

_____

_____

_____

6. What would you like each of the following to do to help you next year to think about your future career?

Math Teacher_____

_____

Science Teacher_____

_____

Counselor_____

_____

Parent(s) or Guardian_____

_____

7. Improving technology means making things work better. Can you give examples of technology you would like to understand more or to improve?_____

_____

_____

_____

_____

8. Do you have some special thoughts?_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Teacher comments welcome! Please use other side. 5/14/80

wits MIT Project on Work in Technology and Science

Room 20C-228
Massachusetts
Institute of
Technology

Cambridge
Massachusetts
02139

Telephone
617-253-7378

A SPECIAL INVITATION TO PARENTS AND STUDENTS *

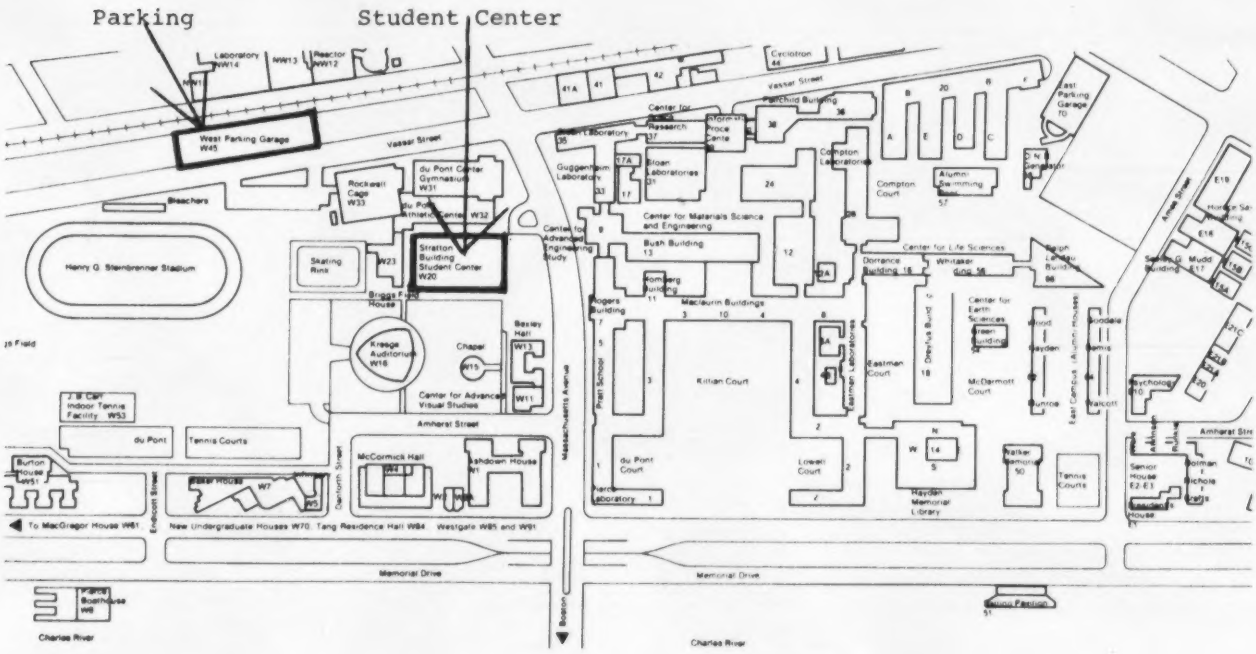
In cooperation with the MIT Open House Committee and with the WESTINGHOUSE SCIENCE FAIR FOR MIDDLE AND HIGH SCHOOL STUDENTS, MIT/Project WITS would like to invite you to an Open House on Saturday, May 3, 1980.

WITS/TSCM staff members will be on hand to greet you from 11 a.m. until 1 p.m. in the West Lounge of the MIT Student Center. MIT students will be happy to give you a short tour of the campus and its facilities.

Industry representatives will be available to discuss with you and your children the many career opportunities in technology and science-related companies in the Boston area.

Coffee and refreshments will be provided.

The WITS/TSCM staff look forward to seeing you on Saturday, May 3!



*Sponsored by the Boston Public Schools' Emergency School Aid Act funding.

wits MIT Project on Work in Technology and Science

April 16, 1980

Dear Colleague:

This SPECIAL INVITATION FOR PARENTS AND STUDENTS is to be distributed as part of the TSCM program. As you know, involving parents in their childrens' education through career awareness activities is an essential component of our program. We expect the MIT OPEN HOUSE and the MASSACHUSETTS STATE SCIENCE FAIR on SATURDAY, MAY 3, to be very interesting and worthwhile events, and we hope that parents will take this opportunity to explore job opportunities in science and technology.

We have organized our Parent/Student event in the following manner: WITS/TSCM staff members will be in the WEST LOUNGE of the MIT STUDENT CENTER from 11-1 p.m. Coffee and refreshments will be served, MIT student guides will take interested parents and their children on tours of MIT and PARENTS WILL BE GIVEN THE OPPORTUNITY TO RAISE QUESTIONS ABOUT TECHNOLOGY AND SCIENCE-RELATED CAREERS WITH INDUSTRY REPRESENTATIVES.

The MIT OPEN HOUSE and the MASSACHUSETTS STATE SCIENCE FAIR events, which will be conducted from 10 a.m. until 3 p.m., will include: a CHEMISTRY MAGIC SHOW, an exhibit by the SOCIETY OF WOMEN ENGINEERS, a display by GREENSPEAK (a method of using lights to advertise Open House events), and many HANDS-ON EXPERIENCES, DEMONSTRATIONS and EXHIBITS involving COMPUTER TERMINALS and other MIT LABORATORY FACILITIES. The science fair will present SCIENCE PROJECTS INVENTED AND ASSEMBLED BY HIGH SCHOOL STUDENTS from the Greater Boston area.

PLEASE URGE YOUR STUDENTS TO BRING THEIR PARENTS AND COME JOIN THE FUN. YOU MAY WANT TO SUGGEST THAT STUDENTS LOOK OUT FOR THE SCIENCE FAIR AD IN THE BOSTON GLOBE, AND YOU MAY ALSO WANT TO POST THE AD ON THE SCHOOL BULLETIN BOARD!

Thank you.

Cordially,
Edith Rusinow

THE WITS/TSCM STAFF

ap

Appendix C-1 Explaining TSCM Program to Organizations

wits MIT Project on Work in Technology and Science

Room 20C-228 Massachusetts Institute of Technology

Cambridge Massachusetts 02139

Telephone 617-253-7378

You will recall our phone conversation about the MIT/WITS TECHNOLOGY AND SCIENCE CAREERS FOR MINORITIES (TSCM) program. WITS is planning programs for Boston educators so that they can increase minority students' interest in math and science and expand their awareness of technology and science careers as described in the enclosed Boston Public Schools Personnel Circular.

The gist of what we need from you involves industry visits for secondary school students and school visits by industry personnel between January 20, 1980 and June 10, 1980.

Industry Visits for Students: We need companies that will host visits for math or science classes of about 25 students. About 30 such field trips (i.e., 2 per school) will be required. We hope that your company will host more than one such trip.

School Visits by Industry Personnel: We need enthusiastic and articulate technicians, engineers, drafters, programmers, personnel representatives and others who are willing to talk to a class at a Boston school during school hours or to a PTA or teachers' group in the evening or on a Saturday. It would be desirable to have a fair sample of minorities among the discussants, but anyone who can encourage youngsters, including minorities, to pursue technical and scientific careers is welcome. They could discuss their jobs, their own career development, an application of science or math concepts in industry, the outlook for technology and science careers and opportunities for minorities in these careers or other related topics.

About 50 to 60 visits (i.e., 3 to 4 per school) will be required. We hope that your company will make personnel available for several visits. Two talks per visit would work best, one to a math class and one to a science class. Experience suggests that the most effective way is for a team of 2 or 3 persons to visit a school. This allows different specialists, for example, an engineer and a technician, to explain how they work together. It also prevents last minute cancellations in case of one person's illness.

We need your support to help minority youngsters prepare for career opportunities about which they know practically nothing. Your most effective contribution would be to tangibly encourage some of your employees to participate. The enclosed forms should be completed by those in charge of the student site visits, as well as by those who wish to visit a school. May we suggest that you coordinate your company's participation by asking employees to return the forms to you. Of course, we also need the forms, but you might want to keep copies and a list of your participants for your files.

As soon as convenient, we should know the extent of your commitment, so that we can present tentative plans to the teachers' workshops in November and December. Specific arrangements for dates and times will be made after January 20, when either a Boston teacher or WITS staff member will get in touch with you. In addition to circulating the forms and the information contained in this letter, you might want to publicize the TSCM project through your in-house publication.

Thank you for any help you might be able to provide. We look forward to talking to you and to planning specific events. Please do not hesitate to call if you have any questions or suggestions.

Sincerely yours,

Nadine Rodwin

Nadine Rodwin

ap
Enclosures:
BPS Personnel Circular, No. 12, 1979-1980, October 11, 1979.
10 Pink SET Roster Forms.

P.S. Perhaps your organization is already cooperating with similar programs, such as Mass PEP or the Tri-Lateral Council. If so, we want you to know that we are coordinating our efforts with these groups so as to put minimum strain on limited resources. Our program offers you an additional opportunity to develop the interest of young minority men and women in pursuing technical careers.

Appendix C-2

JOIN THE SET ROSTER

SET

for encouraging Boston minority students to consider careers in Science, Engineering and Technology

join! join! JOIN! JOIN! JOIN! JOIN! join! join!

The Technology and Science Careers for Minorities (TSCM) Project, developed under a grant from the Emergency School Aid Act, seeks to develop a roster of resource people. These people will directly participate in an effort by the Boston schools to increase minority preparation for technological careers.

The SET ROSTER will involve educators, parents, and college students, as well as scientists, engineers and technicians. They will serve as advisors, consultants, speakers, role models, tutors and guides for site visits and field trips. The Roster members will demonstrate that there are real opportunities for male and female minority students who prepare for technological careers.

Most teachers, counselors and students have little or no opportunity to become familiar with the world of work in technological industries. Hence too few students consider careers in those industries. For young people, there is no substitute for the personal communication that SET members will provide as they demonstrate examples of technical and scientific work and talk about their own career development.

We appreciate that for everyone time availability is a problem, and we'll take careful account of that when we ask for help.

If you would like to be a member of the SET ROSTER, please complete the attached form and return it to the WITS office as soon as possible. If you know others who might be interested in joining, please pass on this information, or phone the WITS office.

wits MIT Project on Work in Technology and Science
Room 20C-228 Massachusetts Institute of Technology
Cambridge Massachusetts 02139
Telephone 617-253-7378

wits MIT Project on Work in Technology and Science

Room 20C-228 Massachusetts Institute of Technology

Cambridge Massachusetts 02139

Telephone 617-253-7378

Please type or use black ink.

TECHNOLOGY AND SCIENCE CAREERS FOR MINORITIES (TSCM) PROJECT

SET (Science, Engineering and Technology) ROSTER

The Project seeks a wide range of professional, technical and support personnel to inform Boston students about technology and science career options. If you would like to contribute to the effort to encourage minorities to prepare for technology and science careers, please complete this form.

Name_____ Race_____ Sex_____

Company_____ Department_____

Address_____ Phone_____

Title and Description of Work_____

_____

Which of the following will you be able to undertake between January 20 and June 10, 1980?

1. ____ Arranging a group visit at your company during the work day for about 25 students.
2. ____ Speaking at a Boston school to a class: for example, about your own job and career development, job options in technology and science or a science or math related topic of your choice. (Please specify.)_____
3. ____ Presenting information to parents and teachers concerning student career choice, educational requirements for jobs, etc.

Will you be available during: school hours_____ evenings_____ Saturdays_____

WITS will secure employers' support of employee participation. Would that be desirable in your case? Yes_____ No_____ Doesn't Matter_____

Please list company or professional publications and audio/visual materials useful for teachers or students._____

_____

_____

Please describe related activities, if any, in which you have previously been involved.

_____

_____

Please describe any organizations you are or have been affiliated with that have similar objectives to the TSCM Project._____

_____

_____

Please suggest others who may be interested in being included in the SET Roster:

Name_____ Organization/Position_____
Address_____ Phone_____

Name_____ Organization/Position_____
Address_____ Phone_____

Name_____ Organization/Position_____
Address_____ Phone_____

PLEASE USE REVERSE FOR ANY COMMENTS/SUGGESTIONS.

10/26/79

Appendix C-3 Memo to Speakers Confirming Arrangements

wits MIT Project on Work in Technology and Science
Room 20C-228 Massachusetts Institute of Technology
Cambridge Massachusetts 02139
Telephone 617-253-7378

We are delighted that you have agreed to participate in the TECHNOLOGY AND SCIENCE CAREERS FOR MINORITIES (TSCM) program by speaking at a Boston school.

Enclosed is a confirmation sheet which provides the exact information about the time, place and other particulars of the event. The teachers involved are also receiving copies of this form and will be calling you about one week before the scheduled talk to tell you something about their students and to find out more about you so that they can better prepare their class. Also enclosed is an overview of the whole program so you can see how your talk fits into the broader framework.

Please don't hesitate to call if you have any questions. Many thanks for your help in this worthwhile project.

Cordially,

Nadine Rodwin

Nadine Rodwin

ap
Enclosures:
TSCM Overview
Memo to Speakers and TSCM School Team Members
Memo to Teachers and Speakers

Appendix C-4 Memo to School Administrators Confirming Speaking Arrangements

wits MIT Project on Work in Technology and Science
Room 20C-228 Massachusetts Institute of Technology
Cambridge Massachusetts 02139
Telephone 617-253-7378

MEMORANDUM

TO: TSCM School Team Administrator

Arrangements have now been worked out for a speaker to come to your school to address target classes selected by the TSCM team math and science teachers. You will note that speakers will be expecting a phone call from each teacher to establish personal contact and to discuss the visit.

The enclosed confirmation sheet provides the necessary information. We would appreciate your sending a copy of this form to each one of the persons listed below.

We hope that the speaker's visit to your school will be successful, and that you and the TSCM counselor will be able to attend the class.

If you have any questions or suggestions, please don't hesitate to call or to talk to Richard Deveney.

ap
Enclosures:
Speaker confirmation sheets
Memorandum to teachers and speakers

Math teacher:

Science teacher:

Guidance counselor(s):

Headmaster/principal:

Appendix C-5

TECHNOLOGY AND SCIENCE CAREERS FOR MINORITIES (TSCM)

MEMO TO SPEAKERS AND TSCM SCHOOL TEAM MEMBERS

The following conveys necessary information about arrangements for a speaker visiting middle or high school classes. Speakers will talk informally about their own career development and/or about some interesting technical endeavor leaving time for discussion. The purpose is to increase students' interest in math and science and to expand their awareness of careers in technology and science. Speakers and teachers will discuss in a phone conversation their mutual concerns about the class, the nature of the presentation and requirements for any audio/visual equipment. Teachers should phone the speaker no later than one week before the date scheduled.

Information for Math and Science Teachers

The person named here has agreed to address your class. The speaker will expect you to phone him/her about 10 days before the scheduled date.

Name_____ Title/Position_____

Organization_____ Phone: (Daytime)_____
(Evening)_____

Possible Topics_____

Information for Speakers

Information about School:

Date of School Visit:_____ *Please arrive at school at:_____

Name_____ Directions/Parking_____

Address_____ _____

Phone_____

Participating Teachers:

			From	To
Math_____	Course_____	Time of Class	_____	
Science_____	Course_____	Time of Class	_____	

*Upon arrival at the school, please ask to see_____.
The time of arrival at the school has been set for 20 minutes before the class begins to allow your meeting a school official and to be taken to the class. Please plan to talk approximately 20 minutes and allow 15 minutes for questions.

1/16/80

Appendix C-6

wits MIT Project on Work in Technology and Science

Room 20C-228 Massachusetts Institute of Technology

Cambridge Massachusetts 02139

Telephone 617-253-7378

January 28, 1980

MEMORANDUM

TO: Teachers and Speakers

RE: Phone planning of speaker's visit to school

Some speakers have had little experience talking to a middle or high school class. Speakers will be more comfortable if they can consider with teachers how to pitch their talks. Similarly, some teachers have had little opportunity to deal with people working in technology; so, based on past WITS experience, here are some suggestions of points to cover when you "meet each other" over the phone:

Information about the class - special interests, problems, abilities.

Emphasis upon entry level or college level jobs?

Extent to which students have read about or discussed speaker's field, industry or heard other speakers.

Suggested topics of special interest to students in addition to personal career history and information about careers related to speaker's career.

Possibility of speaker bringing a sample of a part or a product that students could see/touch.

Mention of hobbies/other personal experiences that communicate that "he/she is only human" - demystifying the technologist.

Need for special equipment - audio/visual, tapes, screen, etc.

Travel instructions.

Appendix C-7 Thank You Letter to Panelists

wits MIT Project on Work in Technology and Science

Room 20C-228
Massachusetts
Institute of
Technology

Cambridge
Massachusetts
02139

Telephone
617-253-7378

April 22, 1980

I hope that you enjoyed the April 9 WITS/TSCM discussion: TECHNICAL AND SCIENTIFIC CAREERS IN THE PUBLIC SECTOR as much as we did. The information you presented and the brochures you brought will be most useful to the teachers' discussions of careers. I am sorry that you did not have as much time as you may have liked; but, having many panelists gave us an excellent bird's eye view of the employment opportunities in the public sector.

I do appreciate your informative presentation. Many thanks! I was able to join only a few of the small discussion groups, but I am told that lively discussions went on in many areas. I hope that this is only a beginning for a school-"world of work" relationship and that some of you will cooperate further with the educators you met.

At our next workshop, we will ask the teachers and counselors for their evaluation of the April 9 meeting. But, it is equally important for us to get your reactions to the meeting so that we can modify future programs to reflect more clearly the various needs and interests of participants. We would thus appreciate your comments and suggestions on the enclosed sheet. Please return it to: Project WITS, MIT, Room 20C-228, Cambridge, MA 02139.

Again, many thanks for your interest and participation in WITS/TSCM activities.

Cordially,

Nadine Rodwin

Nadine Rodwin

ap
Enclosure

Appendix C-8 Thank You Letter to School Speakers

wits MIT Project on Work in Technology and Science

Room 20C-228
Massachusetts
Institute of
Technology

Cambridge
Massachusetts
02139

Telephone
617-253-7378

Dear Colleague:

Some time has elapsed since you were kind enough to give a talk at a Boston school. We hope that you found the experience interesting and rewarding, and we are grateful for your participation in this important program.

Although we will not get the teachers' complete evaluations until later on in the school year, the informal feedback we have had so far has been quite positive. In addition to teacher input, though, we would like to have your comments and suggestions concerning your school visit. We hope to analyze teacher and speaker notes and then to modify our program to reflect more clearly the various needs and interests of project participants. We would thus appreciate your comments and suggestions on the enclosed sheet. Please return it to: Project WITS, MIT, 20C-228, Cambridge, MA 02139.

Many thanks for your continued interest and participation in WITS/TSCM activities!

Sincerely,

Nadine Rodwin

Nadine Rodwin

ap
Enclosure: SPEAKER'S COMMENTS ON SCHOOL VISIT

Appendix C-9

wits MIT Project on Work in Technology and Science

Room 20C-228 Massachusetts Institute of Technology

Cambridge Massachusetts 02139

Telephone 617-253-7378

SPEAKER'S COMMENTS ON SCHOOL VISIT

Your reactions to the school visit you made in connection with the TECHNOLOGY AND SCIENCE CAREERS FOR MINORITIES (TSCM) program would be most helpful to us in planning future events. Thank you for participating and for giving us your comments!

Name_____ Organization_____

School_____ Subject(s) & Grade Level(s)_____

Please discuss the following in as much detail as possible:

1. Teacher's preparation of students for your visit (include suggestions for the future):__

2. Brief summary of your presentation and materials you brought/left. What interested students most/least:_____

3. Students' comments/questions about the careers/topics you discussed:_____

4. Your reasons for taking on this school visit (personal, job-related, other):_____

5. Benefits & costs to the school of your visit:_____

6. Benefits & costs to you and your organization of your visit:_____

7. Suggestions for future visits and other ways to teach students about technological work:

PLEASE USE OTHER SIDE FOR ADDITIONAL COMMENTS.

4/8/80